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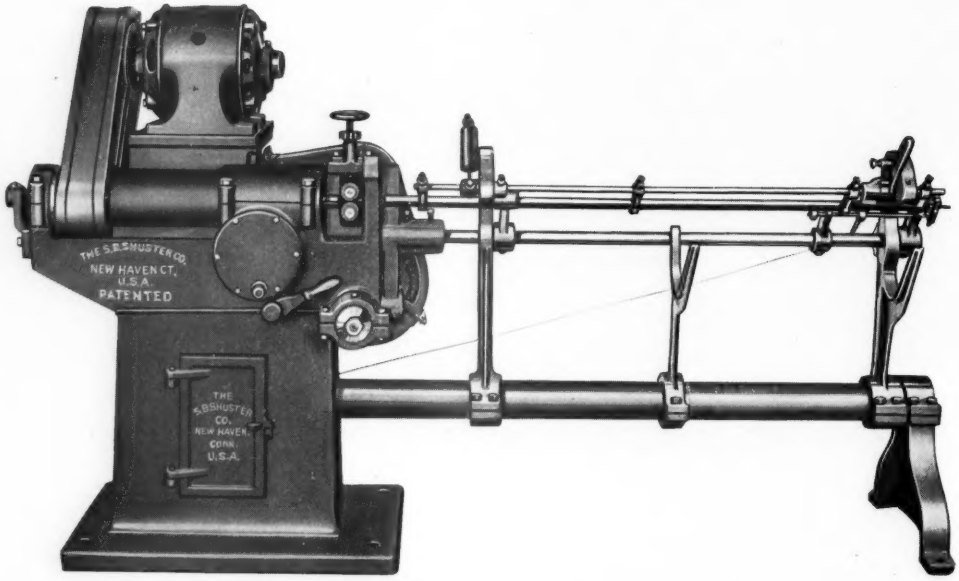

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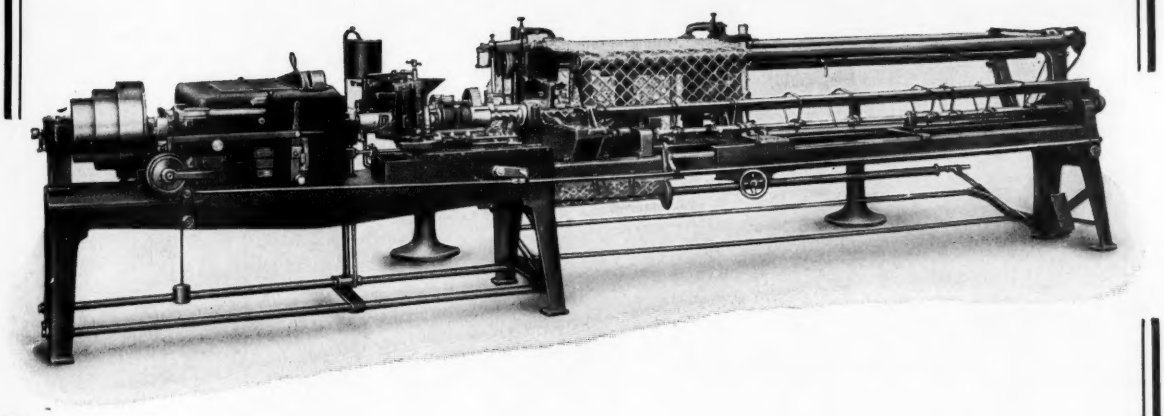

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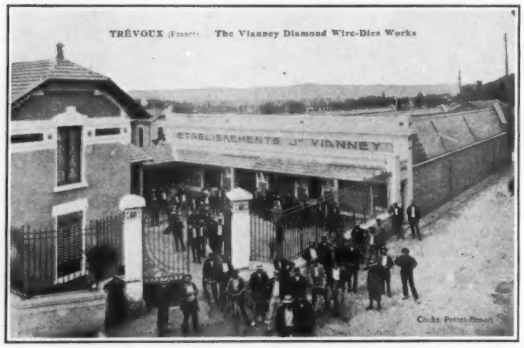

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WIRE & WIRE PRODUCTS

A monthly publication devoted to wire drawing and wire forming

Vol. 3 May, 1928 No. 5

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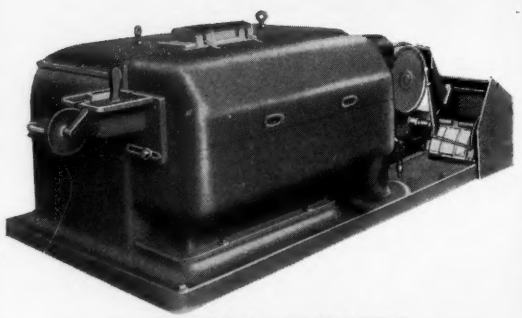

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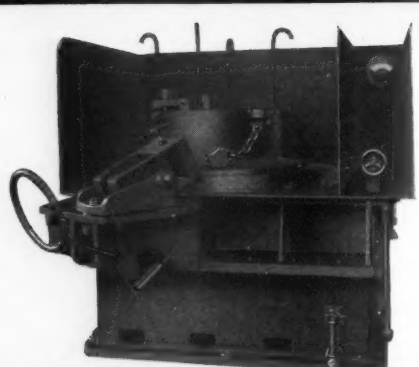

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WIRE & WIRE PRODUCTS

Vol. 3 MAY, 1928 No. 5

The Principal Uses of Steel Wire

A classification of the three most important divisions, with their analyses and physical properties

By J. D. Brunton

Brunton's Research Lab., Musselbergh, Scotland

To give a list of all the articles made out of wire would occupy several pages, and would not even then be complete. If it happened that it was complete today, there would be a new use discovered for wire tomorrow, and the list would soon be out-of-date.

On this occasion, in this Chapter the present principal uses of wire are given, and these have been grouped under three heads:

A Mild Steel Wire,—that is, wire that will not harden and temper by heat treatment.

B Steel Wire with sufficient carbon in it to harden and temper, but supplied in a soft condition.

C Special Heat Treated Steel with a high percentage of carbon, but supplied in the hardened and toughened state.

The above is a very rough classification. Each group can, of course, be split up into a number of classes, such as annealed, one holed, soft drawn, hard drawn, bright finished, lacquer drawn, etc., etc.

Under the first class, "A", comes wire for such purposes as are indicated in the accompanying list.

IN his preceeding contribution the author discussed the consumption of power and flow of metal in steel wire drawing. Following the accompanying article on the composition, properties and uses of steel wire, the same authority will outline the processes involved in the cold working of miscellaneous alloy steels, including high speed and stainless steels containing nickel, manganese, nickel-chrome, tungsten, and molybdenum.

Today, most of the steels used for manufacturing the wires in Class "A",—a number of which are enumerated above — are made in the basic open-hearth furnace. In former days, these wires were either made out of puddled iron or, later, out of Bessemer steel; but since the open-hearth furnace has come into popularity, it has been found that a more homogeneous steel can be made in it: a cheaper base can be used, and the resultant steel is considerably cheaper than either puddled iron or Bessemer steel. By using a basic lining to the furnace, also, a lower grade iron can be used, with a higher percentage of phosphorus than would be possible in an acid lined furnace.

It may, therefore, be taken that for the production of the wires in Class "A" it is fairly universal to use an open-hearth basic steel. The analysis of this steel may vary somewhat, and the subsequent treatment will vary considerably with the ultimate requirements of the wire.

As examples which will serve to illustrate the methods adopted in producing the various classes of wire and the typical analysis and mechanical tests for this material, the following may be given:—

Bale-ties

These ties are usually supplied with one end twisted to form a loop, and are put round bales, hay, straw, and used for general packing purposes. This wire is required to be soft, easily bent, and to have at the same time a certain tensile strength to withstand the stress.

Many of the bales it encircles are put into special presses; and, since the wire is put on while the bale is still under considerable pressure, a certain tenacity in the wire is required. To obtain this, and at the same time to get the wire as soft as possible, it is usual to make bale ties of approximately the following composition:—

Carbon	0.10 %
Silicon	0.01
Manganese	0.40
Sulphur	0.045
Phosphorus	0.045

The mechanical properties of this wire are approximately: Tensile strength, 30 tons/sq. in.; elongation, 28% on 2 in.; torsions, 35 in 100d.

Box-Binding Wire

This wire is usually supplied either tinned or coppered—that is, lacquered so as to prevent rust — and is very often supplied in the flattened state. It is generally used in the form of staples, which are driven into a wooden or cardboard box at the corners, to join the ends together and help to reinforce it. A wire to do this requires a certain amount of stiffness so as to pierce the box in an automatic machine. In a typical case the analysis and mechanical tests of the wire were—

Carbon	0.15 %
Silicon	0.01
Manganese	0.45
Sulphur	0.045
Phosphorus	0.045

Tons/sq. inch	Elong.%	Torsions
40	20	25

Case Hardening Wire

This wire should be of a very special nature, not only because of the purity required on the surface, which has to absorb the carbon in the carburising process, and to stand the drastic quenching operation without cracking, but because great toughness in the core is also demanded. It is essential that the wire or bar used for case-hardening purposes be easily machined in automatic lathes, etc., and to obtain this end, without introducing undesirable impurities to the steel, special attention has to be paid to the casting, hot-rolling, annealing, and cold-working operations. In view of these considerations it is usual, in selecting steel for this purpose, to depart from the general rule in wire of this class and to use a high grade acid open-hearth steel made to approximately the following analysis:—

Carbon	0.10	0.20%
Silicon	0.10	
Manganese	0.40	0.60
Sulphur	0.04	max
Phosphorus	0.04	max

The mechanical properties in the bright drawn condition vary from 28/35 tons/sq. inch tensile strength, with a percentage elongation of 35/25 on 2″ gauge length, and a reduction in area at fracture of 60/50 per cent. An impact test is sometimes called for on this material, and on the Izod 120 ft-lb machine a figure of at least 30 ft-lbs, or approximately 200 ft-lbs per sq. inch, is required.

The steel must be a sound homogeneous steel, free from ghosts, roaks, laps, and all surface defects.

Some Uses of Hardened Steel Wire
(C)

Spring wire.
Armature binding wire.
Tire wire.
Suspension bridge wire.
Crucible cast steel rope wire.
Plough steel rope wire.
Music spring wire.
Scratch brush wire.
Harp wire.
Hat wire.
Lock spring wire.
Safety pin wire.
Sounding wire.
Whip wire.
Aeroplane wire.
Bicycle spoke wire.
Brick cutting wire.
Brush wire.
Patent steel rope wire.
Card wire.
Clay cutting wire.
Piano wire.
Door spring wire.
Mandolin wire.
Kite flying wire.
Cycle saddle wire.
Snare wire.
Etc., etc.

Some Uses of Mild Steel Wire
(A)

Bale ties.
Rivet wire.
Tinned bird-cage wire.
Bolt wire.
Bottle handle wire.
Box binding wire.
Bright basic wire.
Bundling wire.
Button hook wire.
Case hardening wire.
Chain welding wire.
Clothes line wire.
Crimping wire.
Ferrule wire.
Fruit jar wire.
Hairpin wire.
Hose winding wire.
Nail wire.
Annealed binding wire.
Bobbin wire.
Book binders wire.
Bottling wire.
Box hinge wire.
Buckle wire.
Button-eye wire.
Cable armouring wire.
Sealing hook wire.
Chaplet wire.
Core wire.
Double annealed wire.
Florists wire.
Garment hanger wire.
Hose binding wire.
Lacing wire.
Lantern wire.
Muzzle wire.
Staple wire.
Pipe cleaner wire.
Weaving wire.
B. B. wire.
Tag fastening wire.
Trellis wire.
Lathing wire.
Netting wire.
Fencing wire.
Pea training wire.
Screw wire.
Tack wire.
Label wire.
Telegraph wire, etc. etc.

Under the second Class, "B", comes wire for another set of purposes.

A large portion of the steel used in the manufacture of wire in Class "B", some uses of which are mentioned above, is made in the acid open-hearth furnace, although both electric and crucible steel furnaces are used for these wires. In this class of wire there is a very much wider range of composition than in Class "A." A few typical examples have been selected, and the approximate analysis and tests as the wire is supplied are given.

Bur Wire

This material generally contains a small percentage of tungsten, which increases its cutting properties and toughens it. It is supplied, as a rule, in a polished, burnished condition, in straight lengths; a typical analysis is as follows:—

Carbon	1.00%
Manganese	0.30
Sulphur	0.02
Phosphorus	0.02
Tungsten	2.00
Silicon	0.20

The mechanical properties are as follows:—

Tons/sq. inch. 50; Elong.% on 2″ 5%; Reduction in Area%, 35.

In this class of wire the mechanical properties are not of such vital importance as in the other classes, because when the wire is received it has to undergo a further heat treatment before it is in a temper suitable for the article required. Bur wire is usually made out of crucible cast steel.

Some Uses of Semi-Hard Steel Wire
(B)

Awl wire.
Bur wire (Dentists).
Drill rod wire.
Cast steel wire.
Clock gong wire.
Needle wire.
Fish hook wire.
Key wire.
Sewing machine needle wire.
Knitting needle wire.
Hat pin wire.
Pivot wire.
Screw driver wire.
Ball wire.
Silver steel wire.
Spring wire to harden and temper.
Clock wire.
Pinion wire.
Corkscrew wire.
Gimlet wire.
Key ring wire.
Latch needle wire.
Crochet needle wire.
Eye-glass wire.
Firing pin wire.
Ring traveller wire.
Etc., etc.

COMPOSITION AND ANALYSES—STAINLESS STEELS

(1) Best Patent Steel

Average Analysis

Carbon	0.55 /0.60%
Silicon	0.15
Manganese	0.70
Sulphur	0.04
Phosphorus	0.04

Tests

Tons /sq. inch	80 /90
Elong.% on 2″	3
Torsions in 100d	35 /40

(2) Special Improved Patent Steel

Average Analysis

Carbon	0.60 /0.65%
Silicon	0.18
Manganese	0.75
Sulphur	0.035
Phosphorus	0.035

Tests

Tons /sq. inch	90 /100
Elong.% on 2″	2 /3
Torsions in 100d	35 /40

(3) Best Plough Steel

Average Analysis

Carbon	0.65 /0.70%
Silicon	0.18
Manganese	0.75
Sulphur	0.035
Phosphorus	0.035

Tests

Tons /sq. inch	100 /110
Elong.% on 2″	2
Torsions in 100d	30 /35

(4) Special Improved Plough Steel

Average Analysis

Carbon	0.70 /0.75%
Silicon	0.20
Manganese	0.75
Sulphur	0.03
Phosphorus	0.03

Tests

Tons /sq. inch	110 /120
Elong.% on 2″	1.5 /2
Torsions in 100d	30 /35

(5) Extra Special Improved Plough Steel

Average Analysis

Carbon	0.75 /0.80%
Silicon	0.20
Manganese	0.30
Sulphur	0.02
Phosphorus	0.02

Tests

Tons /sq. inch	120 /130
Elong.% on 2″	1 /1.5
Torsions in 100d	30 /35

(6) Galvanized Steel Hawser Wire

Average Analysis

Carbon	0.60 /0.65%
Silicon	0.18
Manganese	0.70
Sulphur	0.03
Phosphorus	0.03

Tests

Tons /sq. inch	90
Elong.% on 2″	5
Torsions in 100d	25 /35

Drill Rod Wire

There are several classes of this material, a typical composition being:

Carbon	1.20%
Silicon	0.18
Manganese	0.35
Sulphur	0.02
Phosphorus	0.02

Screw Driver Wire

This is usually made out of acid open-hearth steel with the following analysis and mechanical tests:—

Carbon	0.75%
Silicon	0.15
Manganese	0.50
Sulphur	0.04
Phosphorus	0.04

Tons/sq. inch, 45; Elong.% on 2″, 20; Reduction in Area%, 35.

Spring Wire to Harden and Temper

This is, as a rule, made out of acid open-hearth steel, but there is such a vast number of qualities of spring wire that it is difficult to put down a typical analysis. We have, therefore, put down the various elements present, and shown to what extent these vary in this particular material.

During the last few years there has been a tendency to increase the percentage of manganese, as it has been found that manganese increases the springiness of the wire without increasing the hardness in direct proportion. This wire has to be varied in carbon and other elements in consequence of the final heat-treatment to which the material is going to be subjected. A different carbon is required for wire that is going to be hardened and tempered in oil from that which is going to be hardened and tempered in water. This class includes spring steel wire, which is different from spring wire. Spring wire is, as a rule, sent from the works in a springy condition by suitable cold working; whereas spring steel wire is merely wire drawn from steel which can by hardening and tempering be made into a spring. Generally spring steel wire is supplied in a soft condition.

The compositions of these wires vary according to the grade of spring required, and suitable heat-treatment applied.

Composition of Spring Wire

Quality of wire	Carbon	Silicon	Mang.	Sulp.	Phos.
Mild spring wire	.60 /.70	0.15	.30 /.90	.04	.04
Medium spring wire	0.75	0.15	.30 /.90	.03	.03
Clock spring wire	1.00 /1.10	0.20	0.40	.02	.02
Silver steel wire	1.20	0.20	0.40	.02	.02

Ring Traveller Wire

This wire has to be most accurately drawn; have a perfectly smooth surface; and must not vary from the point to the back end of the piece.

Approximate analysis:

Carbon	0.45%
Silicon	0.15
Manganese	0.70
Sulphur	0.04
Phosphorus	0.04

After being supplied to the maker, it is made into small ring travellers, which are flattened, bent, hardened and tempered. So accurate have these to be made that a thousand of them have to weigh an exact number of grammes, a few more or less will vary the twist put on to cotton.

In Class "B" also falls some of the special alloy steels—such as stainless and high speed steel wire. Several grades of high speed steel are drawn into wire for drills and other tools. The four selections given here are typical.

Stainless steel wire is now drawn for a variety of purposes as a substitute for spring steel wire and silver steel. It is generally supplied by the wire man-

(*Please turn to page 170*)

Composition of Special Alloys

		1	2	3	4
	Carbon	.50 /.70	.50 /.70	.50 /.70	0.67
	Chromium	3 /4	3 /4	3 /4	3.27
High	Tungsten	12 /13	14	17 /18	18.08
Speed	Vanadium	nil	.5	1.0	.89
Steel	Silicon	.1 /.2	.1 /.3	.1 /.4	.44
Wires	Manganese	.3 /.6	.2 /.6	.2 /.4	.195
	Sulphur	0.04	0.035	0.03	0.01
	Phosphorus	0.04	0.035	0.03	0.023

Tinsel Wrapping Equipment

A consideration of some designs for the serving head and the functions of various spindles

By Harrison B. Williams

THE purpose of a tinsel serving head is to automatically wind a yarn or thread of cotton or silk or fibre with a thin metal ribbon.

This winding, or serving as it is called, may be closely spaced so that no part of the yarn core is visible or it may be open spaced, in which case the yarn, often of a different color, is partly visible.

The serving or wrapping may also vary in other ways. In some types of tinsel thread the wrapping is very tight as well as very close, yielding a thread of great brilliance and appearing even under the magnifying glass as a continuous tube of metal. In other cases the wrapping is loose, sometimes so loose that the circumference of a turn of the metal ribbon around the yarn is three or more times the outside diameter of the yarn. Loose serving of this nature is frequently passed through rolls to flatten the product, altho in the case of pot rag tinsel, loosely served, the rolling operation is not required.

As the number of turns of tinsel ribbon per inch of yarn may vary from say twenty five per inch in space cord or Christmas tinsel cord to seventy five turns per inch in telephone tinsel and up to twice this number in fine tinsel thread it becomes important that the serving spindle be capable of high speed in order that the investment in equipment may be kept down. Experimental spindles have been made with an electric motor armature mounted directly on the spindle, that have attained a speed of twenty five thousand revolutions per minute. This speed is beyond the best range secured commercially in quantity production and is not commercially feasible.

A ball bearing spindle may be operated at over seven thousand revolutions per minute and this speed is well within the limits of commercial feasibility.

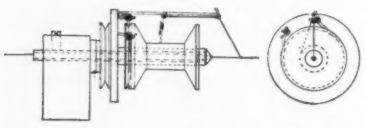


Fig. 1—French wood serving head which may be used as basis for design of tinsel serving head.

PREVIOUS contributions that have appeared in this series on the manufacture of tinsel have covered the continuous plating of wire, the range of tinsel products now marketed, and the equipment required by the wire manufacturer to produce tinsel. The accompanying article is the concluding one of the present series of articles.

Types of Serving Spindle

The requirements of a serving spindle are (1) High speed. (2) Ability to stop one spindle without shutting down the frame, which may carry as high as two hundred spindles, one hundred on each side. (3) Ability to vary the tension on the ribbon being served. This tension control may or may not be adjustable while the spindle is operating. It must have a means of rotating a spool of tinsel at high speed upon its longitudinal axis as in this manner the effect of centrifugal force is at the minimum. The speeds required do not permit an arrangement such as a stranding machine. The rotating spool must have a clear path through its center for the passage of the thread being served and this passage must be clear throughout the length of the spindle and must have its walls stationary. There must be a means of permitting the spool of tinsel which is being served to rotate either slightly faster or slightly slower than the spindle is turning so that as the ribbon winds upon the yarn the spool may slowly turn and feed out more ribbon but feed it out only as fast as it is being required and always under exactly the same tension. This tension must be under control. The spindle must also have all wearing parts so designed that it will have a long life.

In Design No. 1. a spindle used in great numbers in France is shown. It fulfills every requirement listed in sufficient measure to meet tinsel serving requirements in France where labor is available at low cost and where the serving operators have been trained for generations. In this spindle the center or dead spindle is of steel very carefully fitted to the live spindle. The live spindle is partly of wood with a steel tube and music wire flier.

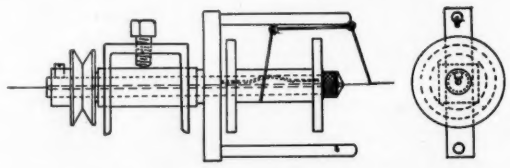


Fig. 2—A serving head adapted from the design in Fig. 1.

The brake mechanism used to

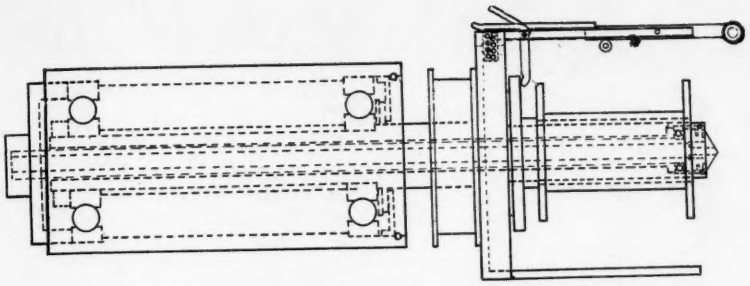


Fig. 3—Ball bearing tinsel serving spindle with automatic tension and with flier unaffected by centrifugal force.

allow the tinsel spool to slowly creep or rotate as the tinsel winds about the yarn consists of a thread attached to an eye at one end. The other end is fastened to the flier in such manner that a slight pull upon the tinsel ribbon will release the thread brake and permit the ribbon spool to rotate until the tension on the flier is relieved. The brake drum is an integral part of the tinsel ribbon spool and the ribbon is wound directly upon these spools at the rolling mill.

Design No. 2. is a crude serving head used in a small way by a few tinsel space cord manufacturers in the United States. It is not suitable for any serving purposes except the very crudest of tying yarns. In this serving head the spool is allowed to creep by a phosphor bronze spring pressing against the inside of the spool. The tension is not adjustable as in the French type where the thread brake may be taken up or let out and in type number two the action of the creeping release is not automatic as in the French type. Only a coarse tinsel thread can be served on this spindle.

Design No. 3. shows a ball bearing steel spindle with a bakelite flier disc and a duralium stamping mounting the flier mechanism, which is balanced against centrifugal force. The balancing of this spindle must be done by hand and in this operation metal is removed from the duralium stamping until the spindle is quiet at the speed desired.

In Design No. 3. the tension required to pull the ribbon off from the spool is the same at any speed and once the tension required has been secured by the adjustment of the flier spring the spindle will function at any speed within its range without special flier tension adjustment. This is not true of spindles of the French type or in spindle No. 4. where the centrifugal force acting upon the flier increases as flier speed is increased so that any variation in the frame speed causes a variation in the serving tightness.

It will be noted that in Design No. 3 the spindle consists of a 3/16" diameter shelby steel tube running through the center and having at the left hand end or rear a nut used to pull the tube firmly against the stationary end of the spindle. It is held by a shoulder at the end of the tube resting against the inside of the left hand end of the spindle. At the other extremity of the inner tube or dead spindle is a small ball bearing and at the right hand end or front is a closing nose with a small hole through the center. This nose holds the yarn in place while it is being served and in one type of spindle designed by the writer this nose has an adjustment of 7/8", being thrust forward by a small coiled spring bearing against the inner race of the ball bearing. Adjustment is made by means of the nut at the rear of the spindle.

The use of this adjustment is to keep the nose very close to the serving point where the tinsel ribbon is being wrapped around the ribbon and the arrangement allows such adjustment while the spindle is in operation.

Next to the dead spindle just described comes the live spindle, which extends throughout the length of the spindle, the left hand half carrying two ball bearings, a distance tube to separate them, and a nut to hold them in place. A dust ring and felt washer also are located on the live spindle at the right of the right hand bearing.

The band pulley should be an integral part of the live spindle and the flier disc may be integral with it or it may, as in Fig. 3, be a bakelite ring moulded around the live spindle. In Fig. 3. the flier is mounted upon a duralium stamping cast in place in the bakelite ring.

In Fig. 3. the spool of tinsel ribbon is not mounted directly upon the live spindle altho a spool with one large flange may thus be mounted. Such a spool is shown at the right of the drawing in Fig. 4. In Fig. 3. there is a shell between the tinsel spool and the live spindle and the function of this shell is to hold the tinsel spool by means of its tapered hole and also to act as a means of forcing the tinsel spool to rotate with the live spindle. This is accomplished by the friction between the fibre washer and the shell caused by the finger, spring actuated, which extends down from the duralium flier carrier.

(*Please turn to page 172*)

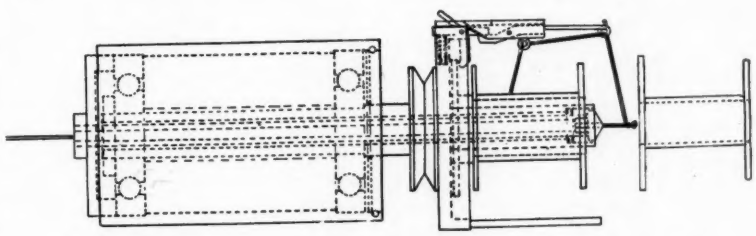


Fig. 4—Serving head designed by the author. The spindle is provided with ball bearings.

Progress of Electric Cable Manufacture In Great Britain

By A. C. Blackall

AMERICAN installations of 132,000-volt cable systems are being watched with interest on the other side, where similar installations may be needed in the projected system now being prepared for the unification of England's power supply. In the past ten years one of the oldest of Great Britain's electric industries has made rapid progress due to the stimulus of post-war transmission requirements and heavier traffic.

THE production of electric cables is one of the oldest of Great Britain's electrical manufacturing industries. Seventy years ago, while the application of electricity to power and lighting was still unknown, the first Atlantic telegraph cable was made and laid by a British manufacturer. Ever since then British cable manufacturers have occupied a prominent position, more than 70 per cent of the existing submarine cables of the world having been made by them.

Some thirty years later, when a demand arose for cables for the distribution of electrical power, the experience already gained of submarine cable could be turned to good account. At first the new cables were insulated with rubber, but as rubber was at the time so expensive many experiments were made with other types of insulation. Barely forty years ago Ferranti built the first paper-insulated high-tension cable for transmitting power from Deptford to London, and although it was some years later before impregnated paper was established as a standard dielectric, it is the only type used for high-voltage distribution at the present time.

First Undergound Lines

The telephone cable, although in one sense more closely related to the telegraph than the power cable, was a later development. The high capacity of the underground cable was at first a serious difficulty in the transmission of telephone currents of audio-frequency, and it was not until the low-capacity, dry-core cable, in which the conductor is insulated with a loose wrapping of paper, had been developed that transmission lines began to be transferred from overhead to underground and the ugly forest of lines which decorated the roofs of city buildings thirty years ago started to disappear from the scene.

Passing over the intermediate development stages, it will be of value to review briefly the progress made in each branch of cable production during the last ten years of rapid evolution.

Prior to the war the successive increases in the speed of transmission had been achieved mainly by modifications in the terminal apparatus, and methods of operation. The fundamental structure of the cable itself had scarcely changed. From the 15 letters a minute in one direction, which was the maximum rate attained with the first Atlantic cable, speeds had been steadily raised until for several years they had remained stationary at a transmission rate of about 300 letters per minute in each direction. The increased traffic demands during the war stimulated research into the possibility of still further increasing transmission speeds. In 1887 Heaviside had pointed out the theoretical advantages of loading the conductor—that is, by adding inductance to the conductor and so overcoming some of the disadvantages arising from its high capacity. Some practical applications of this method had begun to be made on land lines either by adding inductances at intervals or by a continuous wrapping of iron wire around the conductor. The latter method had also been applied to short-distance submarine cables, such as those between Britain and the Continent. For long lines, however, the magnetic materials then known were unsuitable. With the weak currents employed, the magnetization was so low that no better results were obtained than with the unloaded cable.

Introduction of Permalloy

The discovery of "permalloy" in the laboratories of the American Telephone and Telegraph and Western Electric companies made the next advance possible. This nickel-iron alloy has many times the magnetic permeability of iron at the low magnetizing forces resulting from the weak telegraph currents. It has also a much higher resistance than pure iron, which prevents undue increase of effective resistance from eddy current loss. Much laboratory experimentation was necessary to evolve a practicable method of applying the material, but tests on conductors so loaded indicated that considerable advantages would be obtained. The Western Union Cable Co. appreciated the advantages to be gained, and arranged with the Telegraphic Construction and Maintenance Co., Greenwich, to make a cable for a test. A trial length of 120 miles was first constructed and laid off Bermuda to determine whether the characteristics obtained in laboratory tests would be maintained under the strain of laying and at the pressures experienced at vast depths. The trial was successful, and there-

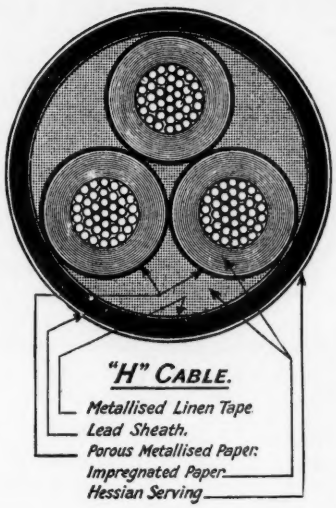
fore the New York-Azores cables was proceeded with and completed in 1924. This immediately gave a signalling speed in one direction of five to six times that obtainable with the former unloaded cables.

The success of the trial led to orders for further similar cables, and the same firm next manufactured the New York Bay-Roberts-Penzance cable for the Western Union. The Bamfeld-Fanning-Island Suva cable laid for the Pacific Cable Board was also of the new type, the work being carried out by two firms. The section from Fanning Island to Suva was manufactured and laid by Siemens Brothers, and for this cable an improved form of permalloy containing a percentage of chromium was used, giving a higher resistivity and somewhat greater stability. The longer section from Bamfeld to Fanning Island was manufactured and laid by the Telegraph Construction & Maintenance Co., using a further modification of permalloy named "mumetal." The cable from Cocos Island to Western Australia was likewise of this type.

This brings development up-to-date, but research is still being actively prosecuted and there is every reason to anticipate further developments in the near future. Successful duplex operation of the loaded cable, for example, would again double the operating speed.

Use of Thermionic Tube

The principal feature of telephone cable progress during the last ten years has been the development of the underground trunk network. Heaviside's theories on the advantage of adding inductance to telephone circuits had begun to assume practical shape on overhead lines some ten years before the war, but their application to long-distance underground cable had not been carried far when development was stopped by the war. With the resumption of work in 1919 it was stimulated by the application of the Fleming thermionic tube as a telephone repeater. The principle is that now used by every radio set amplifier. Instead of having to design the cable so that the original current reached the distant end with sufficient strength to operate the receiver, it was possible to allow much greater attenuation in the cable and consequently to use smaller conductors, the weak current being periodically amplified in a repeater station. The smaller conductors permitted far more circuits than before to be carried in a single underground duct. The London to Bristol trunk cable, for example, contains 308 pairs of wires in a sheath less than three inches in diameter, allowing 462 independent conversations by the use of phantom circuits superimposed on two pairs. Had it been necessary to provide for the same traffic capacity by overhead lines, the highway would have been disfigured by six or more heavy pole routes all liable to interruption in bad weather.



Each improvement in circuit arrangement makes a corresponding further demand on the cable manufacturer if the full advantage is to be obtained, and as a rule the cable which was sufficiently good for the simpler circuits would not operate at all under the new conditions.

The addition of loading reduces the attenuation not only of the operating current, but also of any disturbing current set up by interference, and demands still better balancing. It also accentuates the importance of leakage and therefore necessitates higher insulation resistance. When repeaters are employed still more stringent demands are made on the cable manufacturer. The possible gain at the repeater station is limited by the degree of balance which can be maintained between the line and the balancing network which is employed and this balance must be maintained at all frequencies within the range required for speech transmission. For economic reasons also the balancing networks employed should be interchangeable. The cable must, therefore, be constructed with the greatest possible uniformity so that all circuits in it possess similar characteristics. At points near repeater stations a circuit transmitting in one direction in which the current has just been amplified will be in the same cable with a circuit transmitting in the opposite direction, where the current is arriving at its maximum attenuation. The maximum interference is probable in such cases, and the cable balance must be unusually good. In fact, for very long distance circuits it is customary to reserve certain circuits for transmitting in one direction only to keep these two groups of circuits screened from each other in the cable. It is possible, of course, to improve the cable balance to some extent when joining lengths in the field, but so many factors may affect the overall performance that a very high degree of balance is essential in factory lengths. Steady progress in the uniformity of materials used and in manufacturing processes has enabled cable makers to keep pace with requirements.

New Transmission Schemes

So complex are the interactions between cables, loading coils, and repeaters, however, that it has become necessary to engineer a transmission scheme as a whole instead of regarding

it as a series of independent links. If this is necessary for international telephone systems, it is equally so for the international lines, but even six years ago no organization existed for the purpose. The lead was given by Frank Gill, European chief engineer of the International Standard Electric Corporation. In his presidential address to the Institution of Electrical Engineers in London in 1922 he outlined three possible methods of securing the necessary uniformity in the design of an international telephone transmission scheme. One of these was carried into effect, and at an international conference of telephone administrations held in Paris in 1923, it was decided to form the Comité Consultatif International des Communications Telephoniques a Grande Distance—known briefly as the C. C. I.—which should endeavor to obtain international agreement regarding the characteristics of each part of the transmission circuit so that through working would be possible.

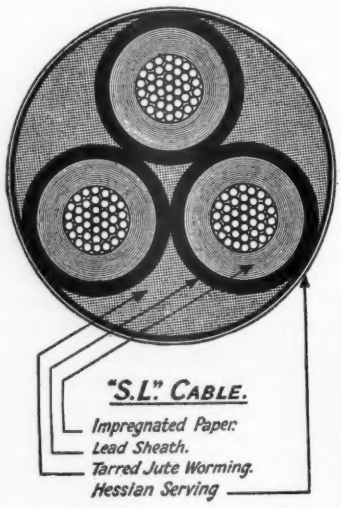
Model Specifications

The British Post Office Engineers took a leading part in this work, one section of which has been the drafting of a model cable specification. The requirements of this specification have now been incorporated in the British Post Office specification, and although the standard set is naturally high, the leading British cable makers can produce cable having characteristics well within the tolerances permitted. Rapid progress has since been made. For example, it is now possible to telephone over 1,200 miles from Glasgow to Konigsberg, and at no distant date it will be possible as a normal procedure to make telephone calls on underground cable circuits, fee from interruption by the storm, between subscribers in any part of Central and Western Europe.

Although power cable dimensions for pressures up to 11,000 volts had been standardized before the war, there was no definite data on the load such cables could safely carry. One of the first tasks undertaken by the British Electrical Research Association on its formation in 1920 was to complete the research on the current-carrying capacities of lead-covered cable commenced several years before by the Buried Cables Sub-Committee of the Institution of Electrical Engineers. Tables of carrying capacities for all standardized cables were published in 1922 and have been of enormous assistance in planning distribution of networks.

The most marked feature since the war has been the steady trend towards the concentration of generation in fewer, larger, and more highly efficient stations interlinked with each other for mutual assistance and greater economy of operation. The longer distances between these stations and between them and their loads have in turn created a demand for higher operating pressures, which have necessitated a totally different outlook in cable design and construction.

At first this was not fully appreciated, and the earlier cables, constructed for such pressures as 33,000 volts, were made on similar lines to those which had proved satisfactory for so long at 11,000 volts. They were of the belted type. Repeated failures in service led makers to re-examine the problem, and much research work was undertaken both by those whose cables had actually failed in service and those who had not at the time installed cables for such pressures. As the operating pressures were raised it was necessary, in order to build cables of a size that could be conveniently handled, to work the dielectric under greater intensities of electrical stress, and it was soon appreciated that the losses in the dielectric which were a negligible factor at 11,000 volts might be of great importance under double the working stress. Steps had been taken to keep these low by care in drying the paper insulation and in the choice of insulating compounds, which were now universally of the mineral oil type.



Causes of Failure

Many of the cables which failed, however, had passed satisfactory dielectric loss tests in the works and had withstood test pressures of two and one-half to three times the working pressure. Short lengths tested to breakdown had withstood five to six times the working pressure before failing. The absolute value of the dielectric loss did not, therefore, seem to be the direct cause of failure.

Records of cables in operation were examined, from which it appeared that those that had not failed had usually been lightly loaded, and had consequently not been heated to any extent in service, while those which had failed had usually done so at periods of light load following on periods of heavy load—namely, after cooling down. Examination of the cable also showed that failure had apparently commenced by burning along the surface of the dielectric where the three insulated cores were in contact; not, be it noted, where the electrical stress was most intense—next the copper wire core. Three factors therefore appeared to be acting together to produce failure after a period of operation:—

1. The fact that in the belted type of cable the stresses are not always at right angles to

(*Please turn to page 174*)

Radio Develops New Wiring Needs

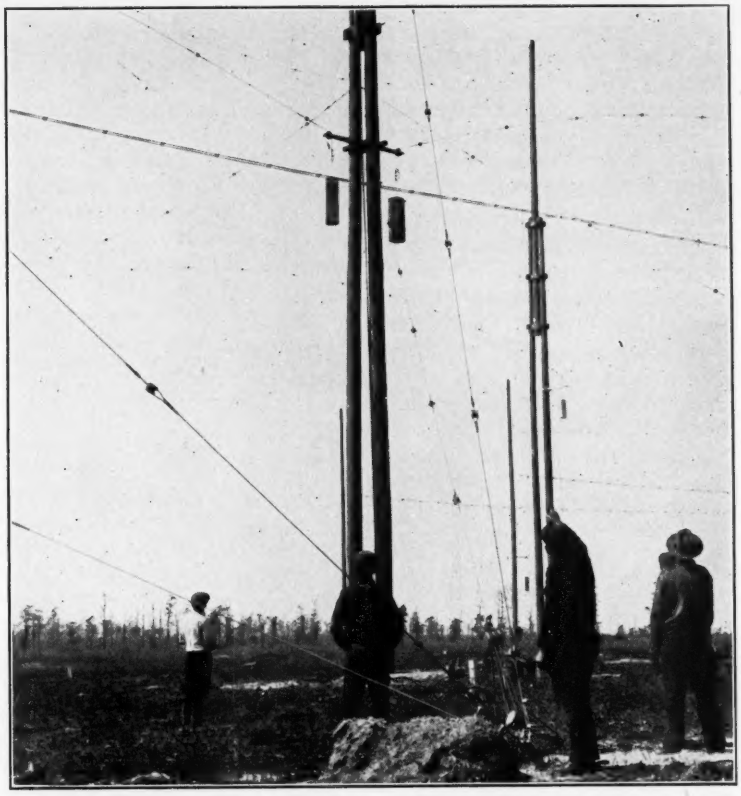
TRANSATLANTIC sending stations are now abandoning the old familiar type of lofty steel tower for an arrangement of masts and wiring like that indicated in the photograph of the new equipment at Rocky Point, Long Island. Coincidentally the Department of War announces an elaborate program of service tests for mobile radio sets at nine military posts. The new equipment has been manufactured and distributed.

For the radio sets for which the new tubular mast introduced by the Signal Corps was developed it is necessary to provide an antennae system extensive both in ground area and height. The new antennae used as part of this equipment forms an umbrella pattern with 12 wires. These wires are 98 feet long, with a ball connector fastened into the mast cap. The other end is connected through four insulators in series to 150 feet of sash cord rope.

Construction of Antennae

Each antennae has a counterpoise instead of a ground. They are 175 feet long, with a ball connector fitted into a fixture near the bottom of the mast and the other end connected through four insulators in series to 60 feet of sash cord rope.

The support for this network of wire is a new type of mast made of tubular steel, which has many advantages over the old portable masts of hollow spruce. The wood mast frequently collapsed because of weakness and was not dependable for heights above forty feet, whereas the large antennae now being tested require 80-foot masts. The hollow spruce was cut in sections fifty inches long with a steel tube coupling inserted between sections. The method of erection was to lift the mast bodily high enough to slip a section on to the bottom, this process being repeated until the desired height had been attained. For heights above forty feet the weight of such a mast required the use of a derrick when new sections were inserted from below. The fragility of an eighty-foot mast of this type was its most serious defect.



A close-up of a section of the beam system of antennae showing the new arrangement of wires. This highly efficient projecting apparatus is now in operation at Rocky Point, Long Island.

The new tubular mast of steel is made in sections 8½ feet long to facilitate transportation of the portable equipment. The mast is completely assembled on the ground and then raised into position by means of a short gin pole and a block and tackle. The mast is guyed in four directions. During the erection the two side guys steady the mast, the front guys are fastened to the gin pole to lift the mast, and the rear guys arrest the movement of the mast at the vertical position.

Ten Stations Selected

Ten widely scattered stations have been selected for these tests. They include The Signal Corps Board at Fort Monmouth, New Jersey; the Second Signal Company at Fort Sam Houston, Texas; the First Signal Troop at Fort Bliss, Texas; the Sixty-first Coast Artillery at Fort Monroe, Virginia; the Fifty-second Coast Artillery at Fort Eustis, Virginia; the Sixty-third Coast Artillery at Fort Winfield Scott, California; Langley Field, Virginia; Chanute Field, Illinois; Wright Field, Ohio.

Upon completion of the tests each organization will render a report covering the suitability of the equipment for adoption; disadvantages or defective features of the equipment; and suggestions as to improvements that may be made in the present design.

NEWS OF THE INDUSTRY

New Financing

SWISS-AMERICAN Electric Company, now being financed by American bankers, has been incorpoated in Switzerland by European public utility management and investment companies primarily to acquire interests in electric light, power, and street railway corporations in South America. The company will have substantial holdings in the stock of companies operating in the Argentine and Paraguay. Four American directors will represent local bankers.

ACME Wire Company, New Haven, Conn., stockholders have received circulars from Leonard S. Tyler, former vice-president and general manager of the company, offering to buy one-half the common stock at $20 a share. An alternate proposal is that the stockholders deposit their stock in a voting fund to guarantee support of the proposed new management. The president of the company is a brother, Victor M. Tyler.

ONE of the United States Steel Corporation's wire forming subsidiaries, Cyclone Fence Co., Waukegan, Illinois, has bought the Standard Fence Co., Oakland, California, and Northwest Fence and Wire Works, Portland, Oregon. Both have been Pacific Coast representatives of the present parent company.

Law and Legislation

THE Wire Wheel Corporation of America and the Packard Motor Car Company have been granted a preliminary injunction against Overland Motor Company in a suit alleging infringement of the Cowles patent on interchangeable wheels. The injunction restrains Overland from the sale of detachable automobile wheels with wire construction. The case is a test suit involving the wire wheel industry. Persistent rumors point to the probable merger of several companies engaged in wire wheel manufacture and it is expected that recent court decisions will help hasten the development of plans that hitherto awaited definite decisions.

PLATINUM articles, under a new New York State stamping act, must be marked to indicate a required degree of purity. One of the unique provisions of the statute reads as follows: "If there is any quality mark printed, stamped or branded on the article itself, there must also be printed, stamped or branded on the said article itself the following mark, to wit: a trademark, duly applied for or registered under the laws of the United States, of the manufacturer." Making or selling platinum articles to which is applied the quality mark without adding the trademark is punishable by a fine of not more than one thousand dollars, imprisonment for six months, or both.

PATENTS owned by the government may be released to manufacturers if Congress passes favorably on a bill introduced by Representative Vestal, of Indiana (H. R. 6105). The measure would authorize the government to license patents which it owns to individuals, firms and corporations under regulations promulgated by a commission comprising the Secretaries of War, Commerce and Navy.

HYDROELECTRIC energy to be provided at Great Falls for the benefit of the United States Government and the District of Columbia is the subject of a bill (S. 1749) reported to the Senate April 24.

A NATIONAL super-power system, to be federally owned, is provided in a bill (H. R. 13408) introduced in the house on April 30 by Representative Berger, Socialist member from Milwaukee. Mr. Berger said his measure is designed, among other things, to bring about the development of super-power systems with a provision for giving the consumer service at cost.

Foreign Trade

FOREIGN trade opportunities reported by the U. S. Bureau of Foreign and Domestic Commerce during the month of April include an inquiry from Bathurst, Canada, for barbed wire, coil spring, woven fence, and wire nails (No. 30706); one from Hamburg, Germany, for green wire gauze (No. 30693); and one from Ponce, P. R., for wire nails (No. 30500).

CHILE (30931) is the source of a call for wiring supplies and fixtures, and another South American inquirer, from Dominican Republic (30846) seeks, among other metal products, metal lath and wire nails.

THE prospect of impending conflict between American and foreign aluminum producers was the subject of comment by Basil Miles, American administrative commissioner, at the Paris headquarters of the International Chamber of Commerce. Among other things, Mr. Miles pointed out that the European aluminum cartel is the least known and most efficient of combines. As to speculative comment about the expected international competition, he remarked: "References to the increasing productivity of the Saguenay plant in Canada take note of its potential production, of 18,000 ton a year, equal to present world production, and the low

production costs of this plant. It is thought the pressure of this new source of low cost aluminum will be principally directed to a struggle with steel for the principal joint markets of the United States."

Obituary

ROBERT C. GARRISON, superintendent of the Salem, Ohio, works of the American Steel & Wire Co., died April 11, aged 52 years. Mr. Garrison was formerly identified with the Cleveland plants of the same company and had been in charge of the Salem works for about four years.

John Sommer, aged sixty-two, last of the original members of the firm which established the Keystone Steel and Wire Company of Peoria, Illinois, and lately active in the merger which resulted in the Mid-States Steel and Wire Company of Crawfordsville, Indiana, died suddenly on the morning of April 7 at his home in Peoria, Illinois, following an attack of apoplexy. Mr. Sommer had been identified with the wire fence industry since 1889. At the time of his death he was President of the Keystone Company and of Mid-States Steel, the organization of the latter having occupied his entire time in recent weeks. The Mid-States Company represents an amalgamation of the Crawfordsville Wire and Nail Company, Crawfordsville, Indiana; Dwiggens Fence Company, Anderson, Indiana, and the Adrian Wire Fence Company of Adrian, Michigan.

Building and Expansion

FORSTNER Chain Corporation, Nye Avenue, Irvington, New Jersey, will build and equip a $75,000 addition to their present plant.

COLLYER Insulated Wire Company, Pawtucket, R. I., will build a three-story and basement addition to their present plant on North Main Street.

WISCONSIN Iron & Wire Works, 1660 Booth Street, Milwaukee, has planned an investment of $25,000 for the erection of a one-story addition, 42x64 ft., designed by F. H. Hollister, consulting engineer, 428 Wisconsin Avenue.

USONA MFG. CO., Chouteau Avenue, St. Louis, Mo., makers of architectural and ornamental iron products, will build and equip a new one story building at an expense estimated at $25,000.

LEON H. BRENDLINGER, formerly connected with the William Remppis Co., Reading, Pa., is active in the organization of a new company which will erect a plant at Mt. Carmel, Pa., to manufacture iron fencing and other ornamental iron and steel products.

AN Eastern branch at 264 Colvin Street, Baltimore, has been leased by the Disappearing Screen Co., Inc., of Berkeley, California, manufacturers of patented screen products.

INTERNATIONAL Nickel Co., 67 Wall Street, New York, is arranging to expand and improve its properties at Port Colborne, Ont., at a cost of $12,000,000. This work will include immediate installation of hoisting machinery, air compressors and auxiliary mining machinery, also additional equipment for hydroelectric power development. At a later date, an addition will be built at Port Colborne's electrolytic refinery and other smelter development carried out. They are also contemplating a new electrolytic copper refinery at Copper Cliff, Ont., which is not included in above estimate of cost. Robert C. Stanley is president.

NEW England High Carbon Wire Co., of which Frank Kilmer is president, are laying foundations for a one-story plant, 60x160-ft. at Millbury, Mass. Plans are private.

ROCHESTER Wire Fence Co., Inc., Rochester, New York, has been organized to operate a factory in that city for the manufacture of wire fencing and fence posts.

FIRE destroyed a wing of the plant of Wilson Mfg. Co., manufacturers of wire products, at Niles, Ohio, on April 15. Damages were estimated at $25,000. The intention is to rebuild and equip.

HUB Wire Cloth & Wire Work Co., 18 Chanal Street, Boston, has, for expansion purposes, leased a portion of building at 28 Lancaster Street.

MID-States Steel & Wire Co., Crawfordsville, which was recently formed by the merging of Adrian Wire Fence Co., Adrian, Mich., Crawfordsville Wire & Nail Co., Crawfordsville, and Dwiggins Wire Fence Co., Anderson will remove the Adrian company's plant to Crawfordsville and consolidate with mill of Wire & Nail company, with facilities being provided for production of field and poultry wire fencing, gates and ornamental fence, heretofore carried on at Adrian. The Crawfordsville division will continue the production of nails and kindred products, and the Dwiggins plant will remain at Anderson without any change in production.

THE Rome Hollow Wire & Tube Co., Rome, New York, has been dissolved.

Personal

GUY M. PETERSON, who has been engaged in the realty business, has been made vice-president of the Cheney-Bigelow Wire Works, Springfield, Mass.

Mr. C. S. B. Jackson, formerly of the Norton Iron Works, Ashland, Kentucky, has accepted the position of Superintendent of the Texas Nail and Wire Manufacturing Company, of Galveston, Texas.

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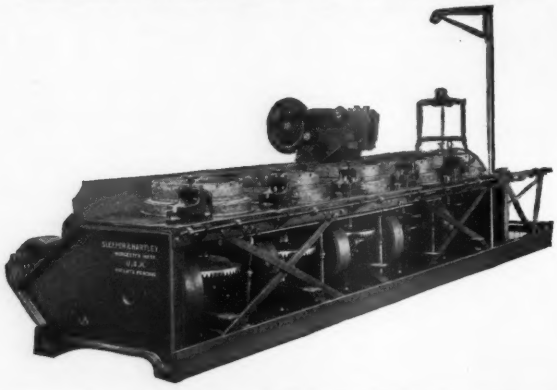
Practical Continuous Wire

These Machines Go Into Production at once—R

Rod Frame

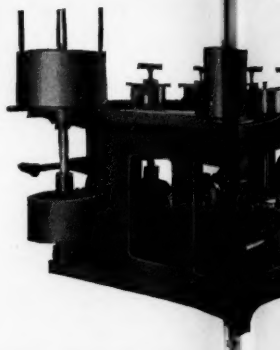
(No. 5—14 or 15 wire)
Patented June 3, 1924—May 12, 1925—others pending
All Ball or Roller Bearings
No Differential Gearing.
Automatic Compensation for Speeds of Heads.



Double 5-Draft

No. 14 to No. 23.
3 to 4 Blocks
No. 14 to 19—4
No. 14 to 20—5

More than 250 heads of



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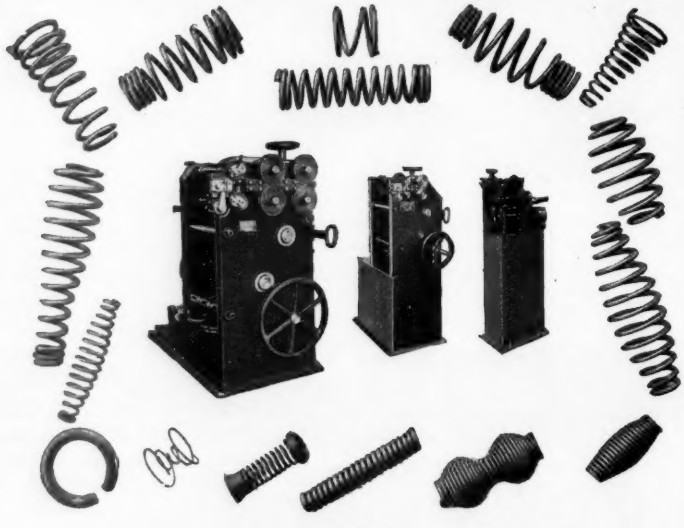

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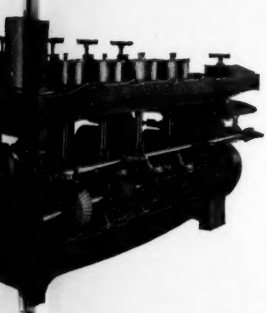
–4 1400 lbs. per block.

–5 1100 lbs. per block.

s of proved model in operation

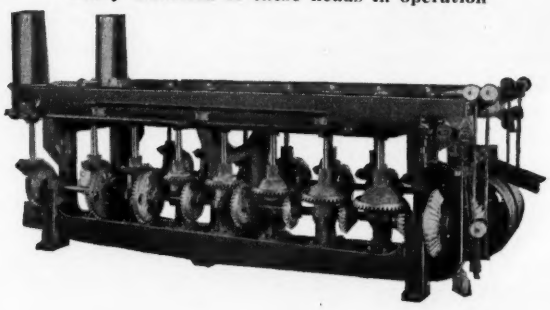


Double 8-Draft Fine Wire: Wet

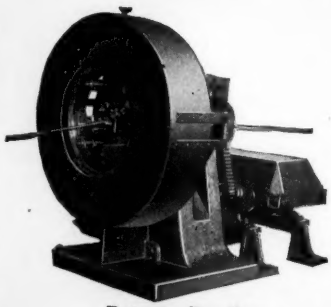
No. 22 to 36. High or low carbon wire.

6 Blocks to Average Operator, 22-33, 8-hole, 660 lbs. per day of ten hours.

Many thousand of these heads in operation



ARMORING MACHINES FOR "BX," PARK CABLE MOTOR WIRES, HOSE Etc., Etc.



Patents Pending

High Productive Speeds

LOCK WASHER MACHINERY

with Enormous Output

HIGH SPEED STRANDING MACHINERY

ARTLEY, Inc.

Agents: Philadelphia Territory
Swind Machinery Co.

ITALY—Henry Coe & Clerici, Milan. AUSTRALIA AND NEW ZEALAND—Edwin Wood Pty., Ltd., Melbourne.
JAPAN—Andrews & George Co., Tokyo. SWEDEN AND FINLAND—Akt., Rylander & Asplunds, Stockholm.

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Editorial By-Products

The Old Days of Barbed Wire

WHEN death recently claimed one of the pioneer barbed wire manufacturers we were reminded of a curious circumstance probably long since forgotten by those not closely identified with that branch of the industry. It was the need for fencing in the huge tracts of grazing land on the Western plains that created the necessity for barbed wire in the first place, and those of us who think of it as an ordinary unromantic product of the industrial age need to be reminded that its introduction was mildly sensational. One of the objections to the round smooth iron wire in use for cattle fencing prior to that time was that the steers rubbed against it, thereby stretching the fences and tearing up the posts. With this picture in mind, zealous humanitarians forsaw herds of bleeding cattle in their vivid imaginations and strenuously opposed the use of the new stranded wire with its "cruel" barbs. Despite their objection, the new fencing was so obviously superior that it caught on at once and has since given humane society officials little if anything to worry about.

Wire and the Fair Sex

FOR another sidelight on the story interest in wire we are indebted to a well known student of the subject, Mr. J. D. Brunton. Mr. Brunton is our authority for the statement that the first wire mill in Great Britain was set up to supply Queen Elizabeth with toilet pins. Later, when the fair sex adopted crinolines, the demand for wire hoops gave the infant industry a great stimulus. If Mr. Brunton were here today instead of in his research laboratory in Harry Lauder's native town we feel sure he would be interested in the enterprise of a famous New York hair dresser who is making advertising capital of his testing machine. The device is nothing more nor less than an apparatus for testing the tensile strength of very delicate wires. Lady patrons are greatly impressed by having a strand from their coiffures "tested" in the machine as a preliminary to treatments prescribed by the professor in charge.

A New Source of Iron

IN a text that is still a terror to school boys, Julius Caesar, in his observations beginning with that famous passage, "All Gaul is divided into three parts", tells of a rich deposit of iron ore that was discovered in the course of his Gallic campaign. After being forgotten or neglected for centuries, this buried field of 50 per cent. iron ore, one of the richest in France, has been rediscovered by geologists lying in a long horizontal strata at Hondouville, near the town of Louviers. Other unworked lodes in France, particularly in Brittany, have been known to exist for centuries but remain undeveloped in favor of deposits in Lorraine nearer the source of the coal supply. At the time of Commander Byrd's flight over France it was held by some engineers that it was one of these iron pockets which threw the compass of the American off the polar attraction, causing an error in navigation which nearly proved fatal.

Engineering by Ear

THE up-to-date engineer, it seems, must now possess a true ear for music among other qualifications. The 575-foot arch span of the new Tyne Bridge at Newcastle, England, is now complete, and the six 10-inch wire rope stays, which held the two halves in position in mid-air, 250 feet above the tideway, have been removed. During the erection of the bridge it was most important, of course, that every one of these gigantic "fiddle-strings" should do its fair share of work. The even distribution of strain was brought about by testing each taut stay with a hammer and observing the pitch of the resulting note. Any slackening of an individual rope was thus quickly detected and at once remedied.

Mexico's Wire Mill

WHAT is said to be the only plant of its kind in all Latin America is now being operated by the Consolidated Rolling Mills and Foundries Co. in Mexico City. Its rod mill output of about six tons per hour will enable Mexico to supply the whole of its wire requirements for telephone, telegraph and electric service and the manufacture of nails. During the past year this concern has also completed the installation of a modern wire drawing plant with a capacity of about 250 tons of various sizes of wire per month, working eight hour shifts.

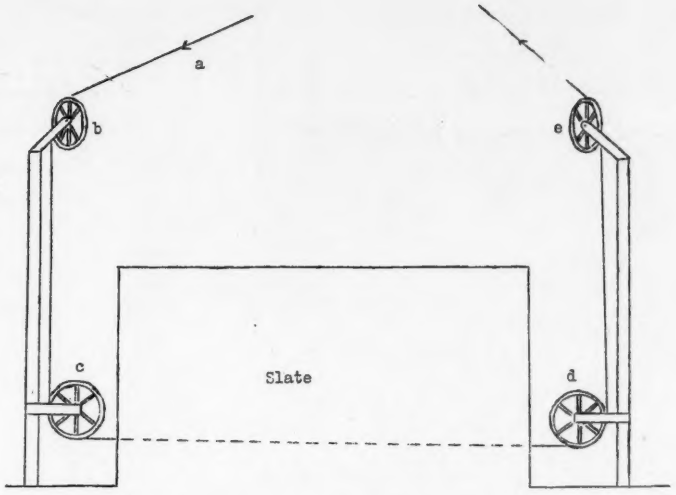
Quarrying With Wire

AFTER a year's trial in the Pennsylvania slate field, the success of the wire saw for quarrying is evidenced by the purchase of complete equipment by six operating companies and of a second complete outfit by the operator who made the first experiment with the saw in co-operation with the U. S. Bureau of Mines. As a result, quarries in other parts of the country are abandoning expensive and wasteful channeling machinery in favor of wire saw equipment. An even wider application of wire for this purpose is in prospect if experiments with other classes of rock turn out to be as successful as the slate cutting tests.

Slate Cutting Wasteful

Slate was selected for the first trial of the new method because it presents peculiar difficulties. The first step in quarrying slate is to separate from the solid ledge masses of a size that may be removed from the quarry. At this stage the waste of material by channeling is greater than at any subsequent step because the heavy blows of the machine, which cuts by reciprocal motion in the same manner as a piston drill, shatters the slate for a distance of one or two feet on either side of the cut. Waste often reached 75 to 94 per cent of gross production. The wire saw, which cuts by a process of steady abrasion, causes no shattering. A channel cut eight feet deep in one of the Pennsylvania quarries had an average width of 2⅜ inches as against a wire cut of only ¼ inch.

The wire saw consists of a three-strand tightly wound steel cable, slightly more than 3-16″ in diameter, running as an endless belt. The wires used have been between 600 and 900 feet long and the belt was



The direction of the wire when the saw is in operation is indicated at (a). It passes through a standard supporting orienting and guiding pulleys, thence through the cut, and on through another standard to the driving mechanism on the quarry bank.

driven by a 7½ h. p. motor through belt and counter-shaft to give the desired speed reduction. The driving pulley is a double-grooved cast iron sheave 40″ in diameter. A weight of from 800 to 1,000 pounds was found necessary to provide sufficient tension. Orienting pulleys 28″ in diameter are provided for conducting the wire from the driving mechanism to the sheaves at the end of the cut in the quarry. The pulleys may be adjusted radially, and a ball-and-socket joint permits orientation to suit the position of the cut. At each end of the saw cut a steel I-beam standard is provided as support for the saw guide sheave. The lower sheaves which guide the wire as it enters and leaves the cut may be raised or lowered on the standards.

The wire saw in operation passes from the standard at one end of the cut through the slate to the second standard, thence to the drive mechanism and back to the first standard. Sand and water are fed to the saw and drawn through the cut by it. The wire travels at the rate of 14.3 feet a second.

The arrangement of the equipment is shown in the diagram. The wire (a) passes over the orienting pulley (b) to the guide pulley (c), through the cut to the guide pulley (d), the orienting pulley (e) and from thence to other orienting pulleys and to the driving mechanism on the quarry bank. The guide pulleys (c) and (d) are fed downward by worm gear to maintain pressure of the wire on the rock as the cut is worked downward. A sharp silica sand is fed to the wire from V-shaped boxes and is carried into the cut by a small stream of water from a rubber hose connected with a pipe line and entering the upper end of the sand box. Three boxes are used, one being placed as close as possible to the point where the wire enters the rock.

Advantages of Wire Sawing

A great advantage of the wire saw is its simplicity and ease of operation. The only attention required consists in maintaining a supply of sand in the boxes, regulating the streams of water, and, at intervals of about every half hour, feeding the guide pulleys at either end of the cut downward a distance of ½ to 1½ inches, depending on the length of the cut and the cutting rate. Another advantage is the ease with which cuts may be made at an angle to the vertical. By inclining the standards the wire may be made to cut at any desired angle.

(*Please turn to page 176*)

DIGEST OF RECENT TRADE LITERATURE

Small Mills Entrench as Mergers Engross the Large Independents. Iron Trade Review, February 9, 1928. P. 379.

In a table given for the purpose of showing the relative standing of the country's producers of steel, as modified by several mergers and combinations, the wire capacity was listed also. The following table gives the wire ratings, relative rank as wire producers, and, for comparison, the last column gives the ranking as steel producers (all kinds):

Company	Yearly Tonnage	Wire Rank	Steel Rank
U. S. Steel	2,248,600	1	1
Colorado F. & I.	300,000		9
Pittsburgh	300,000	2 & 3	15
Bethlehem	205,500	4	2
Jones & Laughlin	180,000	5	4
Gulf States	150,000	6	24
Youngstown-Inland	132,000	7	3
Wheeling	120,000	8	8
Interstate I. & S.	42,000	9	19
Crucible	5,400	10	10

A Novel Schedule of Factory Hours. Industry, January 21, 1928. P. 30.

The machine shops of the Morgan Construction Company of Worcester work on two shifts of forty-four hours each and have been doing so for several years. One shift, the first, works from 6:30 A. M. to 2:30 P. M., excepting Saturdays, when the men quit at 12:30 P. M. The second shift works from 2:30 to 11:40 P. M. daily from Monday to Friday inclusive. This rather unusual arrangement of hours enables the men to get their sleep during the night and still have time for recreation.

Metal Statistics, 1928. Cloth Bound. 4¼ x 6⅛. Published by American Metal Market, 11 Cliff Street, New York City.

Twenty-first annual edition of this handy reference work. Contains a great variety of statistical information about production, consumption, exports, imports, prices, etc., for buyers, sellers and consumers of metals. Trade practices and specifications are an added aid in estimating requirements.

Proposed Aerial Cableway to Summit of Mt. Hood. Engineering News Record, March 17, 1927. P. 447.

Permit Refused to Construct Mt. Hood Cableway. Same. April 21, 1927. P. 847.

Action on Cableway up Mt. Hood Postponed. Same. December 15, 1927. P. 979.

The mountain, near Portland, Oregon, is 11,200 feet high. It is proposed to construct a combination of automobile road, railway, cable operated cars, extensive parking space, etc., at a total cost of approximately $500,000. The company was formed by L. L. Tyler, experienced with aerial cableways in extensive logging work. The initial application through Col. W. B. Greeley, U. S. Forester, was denied. A later application was made to W. M. Jardine, Secretary of Agriculture, who has postponed action for a year, stating that during that time "the potential value of the mountain will be estimated and the best way of conserving it. If the cableway as projected or a modification is best, it will be approved."

The plan incorporates 2¾ miles of railway from the top of the automobile road to the foot of the aerial cableway, with parking space for 1,000 cars near Cloud Cap Inn, at 5,800 feet, where the railway would begin and extend to Cooper Spur, the cars being operated by gasoline engines and huge drums, one winding, one unwinding, the two cables. Some grades are as steep as 50 per cent. The clear span of the cableway would be 6,200 feet from the 50-foot tower at Cooper Spur to the 100-foot summit tower, making it the longest in the world. There would be five cables of high tensile steel, the main cable 2¼ inches in diameter, and two 1⅛-inch hauling cables. Tension would be adjusted by counter balances. Railway capacity would be 120 persons an hour, cableway 60 an hour. The summit terminal would consist of a one-story frame structure 40 x 40, with a small observatory on top.

Large Uses of Steel in Small Ways, Bathroom Fixtures. Iron Trade Review, January 19th, 1928. P. 206. Illustrated.

The uninformed will be surprised to learn that the greater part of present day bathroom fixtures and equipment are made from wire stock and that this light stuff runs into an annual tonnage of 2,000, while strips and sheets used with the wire approximate an additional 1,000 tons a year. Ten years ago all such fixtures were castings or pressed steel, but now wire has proved more usable and better fitted to low cost production in quantity, especially in combination with sheets and cold rolled strip steel. The extent of this business may be judged from the statement of one manufacturer who produces 750 gross of wire bathroom fixtures a week. Wire forming machines produce most of the parts. Spot and butt welding machines join them, so there is little hand labor. Less expensive fixtures are nickel plated and are given no further finish, while the higher class goods are copper finished and enamelled. Plating is all semi-automatic. Enamelling is done in continuous ovens, making this process almost automatic. Three kinds of wire are used—the biggest tonnage in bright extra clean, which is specially drawn with a lubricant to give an unusually clean surface; copper finished steel wire, and a liquor finish.

What articles are you interested in?

THERE have probably been many times when you have said to yourself, "Where can I get this?" The *this* being a piece of equipment or material that you needed.

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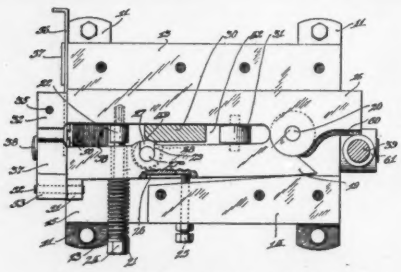
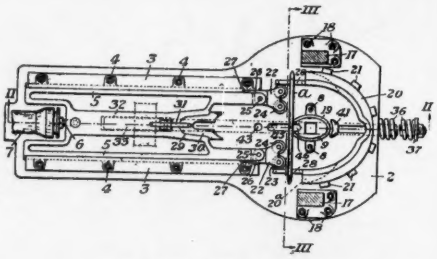
A REVIEW OF RECENT PATENTS



Wire Stripping Machine 1,666,277

Detailed technical descriptions are given only for the devices illustrated. All other descriptions of patents listed on this page have been abstracted from official records.



Chain Making Machine 1,666,380

1,666,745. MESH MACHINE. Fred Harris Lynds, North Attleboro, Mass. Assignor to Whiting & Davis Company, Massachusetts. A machine for the manufacture of link-mesh fabric, which comprises the combination of a support for a piece of mesh, tools for incorporating links in the piece of mesh, means for forming links from blank material and delivering these links to the tools, and power-driven mechanism for giving the tools and the piece of mesh a relative movement to present successive portions of the mesh to the tools and for operating the tools and the link-forming means.

1,666,134. WIRE-CUTTING MECHANISM. Albert Abbe Griswold, Providence, R. I., and Alvin Carroll Goddard, Richmond Hill, N. Y. By mesne assignments to John Francis Chevalier, Brookline, Mass. A wire cutting mechanism comprising a hardened tubular steel wire cutting bushing secured in the frame of a machine and having a small flat wire bore and a squared off wire cutting end, a flat cutting plate having a comparatively large round cutting aperture, the circular edge of the aperture forming a continuous cutting edge larger than the small flat wire bore of the cutting bushing and secured to a slide of the machine and bearing against the squared off wire cutting end of the wire cutting bushing, said slide having up and down movements for the purpose as described.

1,666,277. WIRE-STRIPPING MACHINE. Jessee Mercer White, Philadelphia, Pa. A stripping machine including a fixed gripping jaw, a rockable gripping jaw, means tending to hold said jaws together, a slidable stripping element, a swingable stripping element hinged to the slidable stripping element, means tending to move said elements toward each other, means for moving said elements relatively to the jaws, and means for opening the jaws and separating the stripping elements.

1,666.380. APPARATUS FOR MAKING CHAINS. Albert G. Heinle, Crafton, Pa., assignor of three-eighths to Thomas A. McQuaide, Pittsburgh, Pa. Apparatus for forming chain links, comprising a fixed forming die having a peripheral groove, and unitary means for bending the bar into link form in said groove in a single operation.

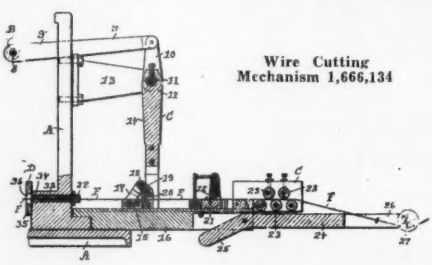
1,666,214. METHOD OF COATING CORES. John Shirley Little. Chicago, Ill., assignor to Western Electric Company, Incorporated, New York, N. Y. A method of coating a core in strand form consisting in subjecting the core to a liquid containing pulp in the presence of soap in such manner that pulp is applied thereto. and then forming the pulp around the core to constitute a coating conforming with the core and retained on the core by a felting of the pulp fibers.

1,666,580. SCREEN. John Henry Park, Harrisburg, Pennsylvania. A wire screen for automobile windshields.

1,665,544. PLASTERER'S GRILLE. George F. Voight, Oakland, California. Assignor to Economy Products Corporation. A combination of wire grille and permanent fastening bracket comprising a two- pronged staple with a spacing element mounted on the free end of one prong.

1,666,670. LIGHTNING-ROD AIR TERMINAL BRACKET. Clement A. Schnoebelen, Cedar Rapids, Iowa. A bracket combined with a lightning-rod, its terminal, and a roof ridge-roll, and adapted to connect electrically with the rod when bent over thereon.

1,666,714. SPINNING-RING TRAVELER. Charles F. Merrill, Hopedale, Mass. Assignor to Draper Corporation, Hopedale, Mass. A spinning ring traveler having a flat inner bearing surface at an angle corresponding to the normal angle of inclination of the traveler when running.



Wire Cutting Mechanism 1,666,134

1,665,539. SPRING STRUCTURE. William A. Falls, Detroit, Michigan. Assignor to L. A. Young Industries. Inc., Detroit, Michigan. Body springs with supporting base, border frame and support for upholstery covering.

1,666,497. ANTISKID CHAIN. Andrew Langstaff Johnston, Jr., Newark, New Jersey. Assignor to Off'N'On Chain Corporation, Newark, New Jersey. An anti-skid chain comprising a side chain, cross chain, and means for forming and joining same.

1,666,120. COIL. Hiram G. Currier, Chicago, Illinois. Assignor to Kellogg Switchboard and Supply Company, Chicago, Illinois. Rectangular shaped core with rectangular shaped winding to form coil.

1,665,761. WIRE FASTENER. George F. Voight, Oakland, California, assignor to Economy Products Corporation. A strip metal base plate with outwardly bending wire support pierced for a projecting nail.

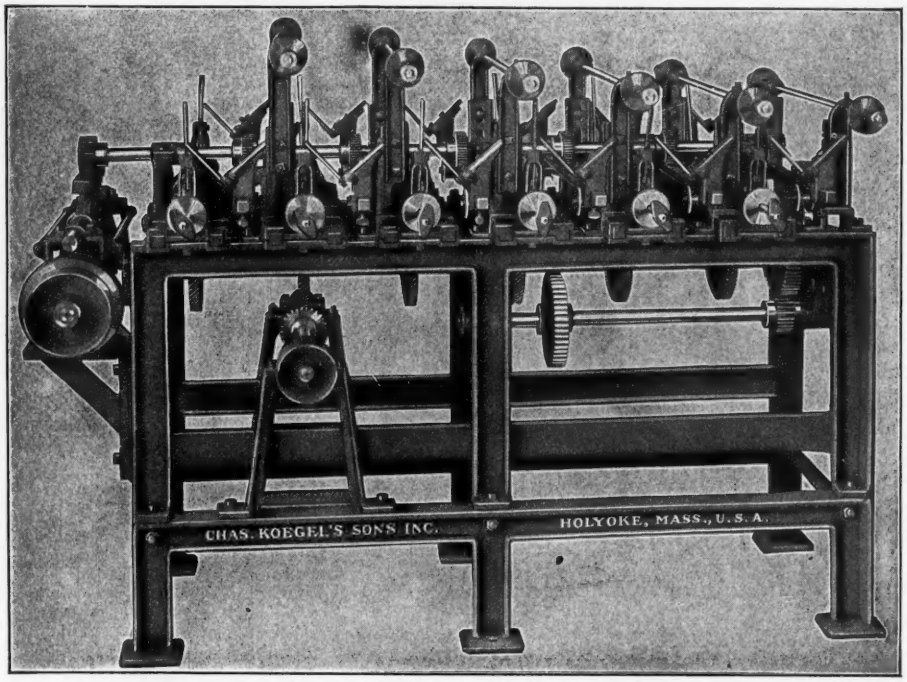
1,666,397. TIRE CHAIN CLIP. James L. Piatt, Wilkes-Barre, Pennsylvania. Assignor to Paul S. Warriner, Wilkes-Barre. A wire tire chain clamp constructed to fit over the tread of the tire and clamp a portion of the chain which it securely holds against the tire under increase of the tire width with partial deflation. (2) A tire clamp constructed to fit over the tire tread and being shaped to facilitate sliding in and out on contact with the ground under lateral bulging of the tire.

1,666,493. WIRE ANCHOR. Albert J. Gurney, Canton, Ohio. Assignor to The American Mine Door Co., Canton, Ohio. A wire anchor having a fixed jaw and a movable jaw, the latter being shiftable.

1,666,535. SELF-FURRING PLASTER NETTING. Otto W. Johnson, Oakland, California. A plaster netting of wire fabric formed of intersecting strands.

KOEGEL'S 12 WIRE TAKE-UP TINNING SPOOLER

6″ Diameter Spool Capacity
Equipped with or without motor drive



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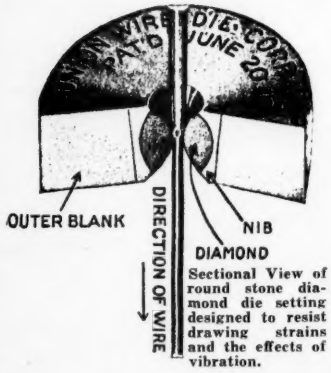

Sectional View of round stone diamond die setting designed to resist drawing strains and the effects of vibration.

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The standard of leading wire mills.

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Use this solution to reduce pollution

DIRT, oil and grease carried into the pickling bath on the surface of wire pollute the acid. Its action is retarded and excessive acid consumption is the result.

To prevent this waste, wire manufacturers have found it good practice to give wire a dip in an Oakite solution before pickling. This removes oil and grease coatings so thoroughly that the acid can then do its work quickly and economically. Time and money are saved. Pickling is complete.

Oakite materials are also used to advantage for neutralizing after pickling and for anti-rusting wire between operations. Full details about their money-saving possibilities are sent on request.

Oakite Service Men, cleaning specialists, are located in all the leading industrial centers of the United States and Canada

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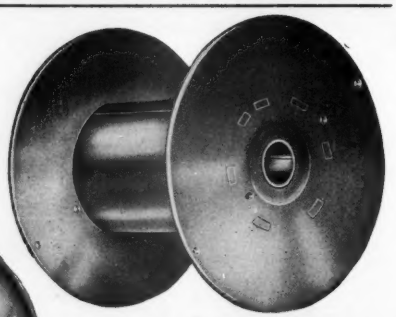
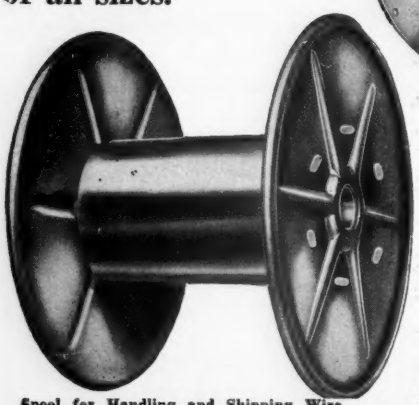


For Annealing and Handling Fine Wire



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The Principal Uses of Steel Wire

(*Continued from page 153*)

ufacturer in the same condition as silver steel—i. e. annealed or lightly drawn and polished, suitable for wire forming and machining—and in this condition it is not stainless.

When the required tool or spring is made, however, it has to be hardened and tempered, and when this has been properly carried out the steel resists corrosion.

Class "C"

This class consists of special heat-treated high carbon wire, which is supplied in the hardened and toughened state.

The wires mentioned in "C" vary anywhere from 50 to 150 tons/sq. inch. A portion of this tensile strength is obtained by cold work, and some of it by the chemical analysis—more particularly the carbon contents, and by heat-treatment.

The main factors influencing the physical properties of this class of wire may be translated as follows:

1. Chemical Composition—Carbon and slighter influence of manganese, phosphorous and silicon.
2. Heat treatment—Patenting process—the most important factors here are the temperature and the rate of cooling.
3. Cold working—(a) Extent of total reduction by drawing, (most important factor.)
   (b) Amount of reduction at each pass.
   (c) Gauge of wire.

The mechanical tests of this wire are of great importance, as there is no further work put on the wire before it is actually employed in the finished article. The carbon contents of this wire vary from .25% up to 1.00%, and it is usual to make this class of wire either of acid or basic open-hearth steel, although there is still some crucible cast steel used for the manufacture

of some of the wires mentioned.

In the three classes of steel there are a few qualities of wire that have more or less standard specifications; and to give the reader an idea of these a few are given, but they have been considerably condensed, the more important points only being mentioned.

Class (A) Specification

Telegraph Wires

Made from mild homogeneous iron or steel, uniformly annealed; pliable; free from scale, flaws, splits, or other defects. The wire shall be drawn in continuous pieces, and shall contain no weld or joint whatever. The wire shall be well galvanized.

Composition

Carbon	0.05%
Silicon	trace
Manganese	0.09
Sulphur	0.02
Phosphorus	0.02
Copper	0.05

Tests

Tons/sq. inch	25/30
Elong.% on 2″	30/25
Torsions in 100d	20

Must have high electrical conductivity.

Class (B) Specification

Cast Steel Wire

Including wire for needles, wax threads, dry thread, hosiery pins, corkscrews, screw drivers, gimlets, etc.

Composition

Carbon	0.45/0.95%
Silicon	0.15
Manganese	0.70
Sulphur	0.04
Phosphorus	0.04

Tests

Tons/sq. inch	40/60
Elong.% on 2″	5/20
Reduction in Area%	30/40

Class (C) Specification

This includes all rope wire, and nearly all hard drawn wire in general. These are graded according to their physical properties, but, generally speaking, the higher the grade of the wire the higher the carbon content. For the higher grades of rope wire Swedish steel, which is low in manganese, sulphur and phosphorus is used. Also in some cases acid quality is called for.

We can classify the rope wires into six classes: this covers ropes for mining, tramways, hauling, winding, ships rigging, elevators, suspension, hawsers, etc.

6-UNIT LAYER-WINDING SPOOLER

SINGLE UNITS OR IN GANGS

Wire from No. 20 to No. 30 B. & S. and from No. 30 to No. 36 B. & S.
—Spools, 3-in. to 6-in. heads.
—Cam Traverse, 2½ to 3½ in.
—Change Gears to vary the rate of traverse.
—Automatic stops.
—Ball Bearing Spindles. (13)

EST. 1855 AIMCO INC. 1918
"American" INSULATING MACHINERY COMPANY
REG. U.S. PAT. OFF.

517 Huntington St.
PHILADELPHIA PENNSYLVANIA U.S.A.

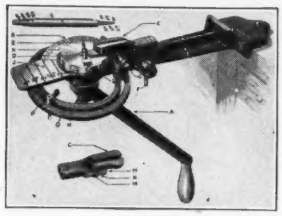
KILMER LITTLE GIANT WIRE FORMER

Forms Eleven Sizes of Eyes from Round, Square, Flat or Half-Round Stock, also almost any shape desired Quickly and Efficiently.

Adjustable for No. 3 to No. 24 Gage Wire.

The cut on the left shows a few of the thousands of the forms made on this FORMER

Price $50.00



Patented April 2, 1918

M. D. Kilmer & Co.

Cleveland, Ohio, U. S. A.
Box 237, Station B.

Steel for Strength

"AMERICAN" Pressed Steel Reels, product of more than 30 years' experience in the manufacture of pressed Steel implements for industry, are built with the same care and precision as are "American" Belt Pulleys and Shaft Hangers. They are true to gauge, as specified, from the largest (8 feet in diameter) to the smallest (2½ inches).

Wire manufacturers have found "American" Reels more convenient and economical in handling their product where process calls for vulcanizing, drawing, annealing, stranding, braiding or impregnating, as well as for shipping. Special Reels or Spools also made to your own specifications... *Write for catalog explaining other features.*

The American Pulley Co.

Manufacturers of Steel Split Transmission Pulleys, Pressed Steel Shaft Hangers, Pressed Steel Hand Trucks and Pressed Steel Shapes

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AMERICAN PRESSED STEEL REELS

Wire Drawing Soaps and Compounds
STEELSKIN BRAND
(Registered)

For High or Low Carbon Wire
Working Samples sent on request.

Established 21 years.

R. H. MILLER CO., INC. **HOMER, N. Y.**

ERNST JELLINGHAUS,
VOERDE i./Westf. GERMANY
Werkzeug-und Maschinenfabrik

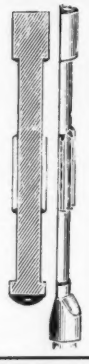
Netting Pinions for Wire Netting Machinery

(For hexagon and triangular netting) made from a Special Steel of about 70—80 kg solidity, and

hardened Screws (bushes for same)

First class workmanship, in all sizes wanted, as per sample or drawing.

also vertical



Metal Spools For Wire Drawing

Metal Spools for Annealing

Metal Lined Spools for Shipping

Metal Lined Reels for Shipping

Hubbard Spool Co.
1622 Carroll Avenue
Chicago

Tinsel Wrapping Equipment

(*Continued from page 155*)

In operation when the ribbon has started to wind upon the yarn the tension upon it causes the flier to rock upon the pin at its center and the left hand end of the flier forces the finger lever, appearing like a cross with one arm bent to the left, to press upon the coil spring and the compression of this spring relieves the tension upon the brake finger. This permits the ribbon spool to slowly creep and feed out ribbon as it is required.

Between the shell and the live spindle is a fibre washer which allows a smoother action in the creeping than can be obtained with a steel surface against steel.

When the shell is eliminated and the large flange type of tinsel spool is used, doffing or the removal of the empty spool is effected by pressing on the lever at the top of the finger brake cross. This forces the arm of the cross stamping down into a slot in the bakelite flier ring compressing the spring to a point where the finger clears the spool flange and it can be removed.

The function of the small ball bearing at the nose of the spindle is to keep the dead spindle from touching the walls of the live spindle. It is held in place by a dust cap and wire ring, the latter being let into a groove for that purpose in the live spindle.

It must be noted that while the inside of the spool is given a slight taper to permit holding friction to keep the spool in place upon the shell, which has its outer surface tapered to the same degree, yet the inside of the shell is parallel and the outside of the live spindle over which the shell fits is also straight, so that in the case of the large flange spools used without a shell, the hole must be without taper. It also must be very carefully reamed as a good fit is essential to high speed

altho there must be no binding. The case enclosing the two sets of ball bearings may be made of either steel tubing or cast iron.

It is important that the right hand outer ball race be free on both sides as the main spindle bearings in this design are to be held by the two inner races and one outer race only.

In Fig. 4. the dead spindle is designed for nose adjustment while operating, the spring not being shown. The flier in Fig. 4. is not balanced against centrifugal force, the duralium stamping attached to the integral steel flier disc being too short to permit the necessary pivoting for a balanced flier.

Flier tension adjustment is secured in either of two ways. Where it is desired to keep this out of the hands of the operators adjustment is secured through the change of springs. Where micrometer adjustment is desired a tension-adjusting screw may be placed either in the disc or on the brake cross or the cross may be divided and the relation between the finger and the spring lever altered by means of shoulder screw and nut.

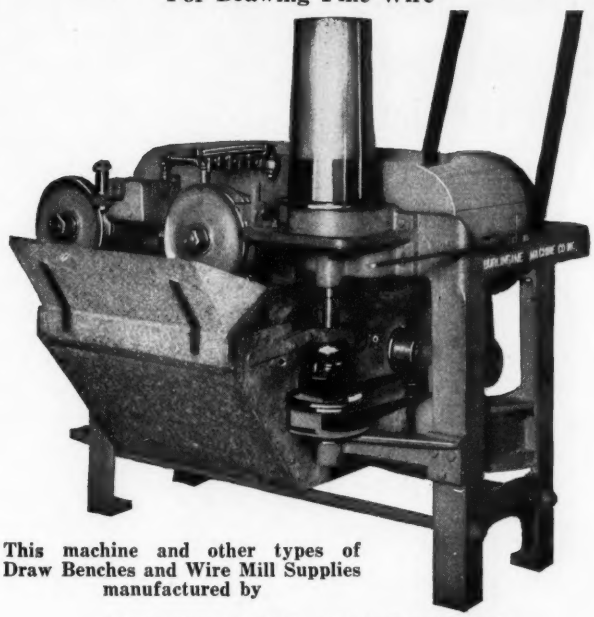
The Bessemer Award

"In presenting the Bessemer Medal to Charles M. Schwab" says the New York Times, the British Iron and Steel Institute pays tribute to a man of imagination and energy who has played a brilliant part in making this an age of steel, and through him to that large class of American metallurgists who reared on Bessemer's great discovery an industry which is one of the marvels of the time. In formulating the conditions under which his medal was to be conferred Sir Henry Bessemer clearly had men of Mr. Schwab's gifts in mind. Honor was to be done not only to technicians and inventors but also to bold, romantic men who saw the possibilities that lie in new methods and machines for reducing iron ore to metal, and who thus contribute to the progress of the iron and steel industry in its larger economic aspects."

Continuous Wire Drawing Machine

6 Draft Liquor Finish

For Drawing Fine Wire



This machine and other types of Draw Benches and Wire Mill Supplies manufactured by

BURLINGAME MACHINE CO.

149 COMMERCIAL ST., WORCESTER, MASS.

M. A. IRMISCHER

Machinery for the Wire Industry

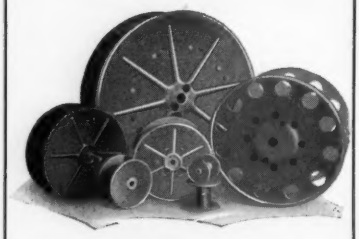
48 EAST 41st STREET, NEW YORK CITY

HIGH PRODUCTIVE:

Bolt Presses
Nut Presses
Rivet Presses
Chain Forming Machines
Pin and Needle Machines
Point Grinding Machines
Poultry Netting Machines
Wire Staple Machines
Wire Spooling Machines
Wire Weaving Machines

Expert Engineer Service available at all times

Pressed Steel Reels and Spools Stand the Gaff of Long Service



APCO-MOSSBERG Steel Spools and Reels are scientifically designed and carefully manufactured to give the wire manufacturer the utmost in strength and wear.

For shop use or shipping there is an APCO-MOSSBERG Spool or Reel ready to cut down your production cost.

Let us tell you all about it.

Apco Mossberg Corporation

13 Lamb St,, Attleboro, Mass.

Specialists in Developing Steel Reels for Annealing, Vulcanizing and Stranding; Also Bobbins for Wire Handling.

Progress of Electric Cable Manufacture in Great Britain

(*Continued from page 158*)

the laminations in which direction the dielectric strength is greatest, but—especially where the insulated cores are in contact—may be along the laminations, where the dielectric strength is much less and the consequent heavy leakance currents will cause slow charring.

2. The springing apart of the three cores due to heating on load or to severe handling caused voids to form, especially in the center of the cable, in which electric discharges took place, further damaging the insulation. Such discharges do not occur at the lower stresses employed in the 11,000-volt cables, although the same expansion and contraction naturally occur.

3. The expansion of the impregnating compound by heating on load distends the plastic lead sheath so that as the cable cools again coids are formed in the body of the dielectric.

Experiments in the laboratory confirmed these explanations.

In recent three-cord cables the first two factors have been provided for by introducing an earthed equipotential metal sheath round each insulated metal core so that stresses are always radial, and even if the cores should separate the space between them is not under stress. Two cables of this type excluding armoring are the "H" cable and the "S. L." cable. In the "H" type a porous wrapping of metallized paper is applied round each insulated core. In the "S. L." type each insulated core is separately lead sheathed, and the three lead sheathed cables are laid up together under a single armor. Trouble due to the expansion of the compound can be minimized by limiting the load and, therefore, the temperature rise of the cable, and it is now the usual custom to restrict the upper temperature limit to 50 degrees C. instead of 65 degrees C., which was current practice for lower-pressure cables.

Proposals have been made to provide for such expansion either by an oil duct in the center of the core or by slots in the inner face of the lead sheath of the "S. L." type, but although such methods have been employed for single-core cables for high voltages, they have not been applied on the three-core types at 33,000 volts. In the "H" cable the filling between the cores which is not under electrical stress can be made to act as a reservoir of compound if suitably constructed, so that it should be practicable to operate this type at higher temperatures, and, therefore, to make it carry greater loads than the ordinary "S. L."

Although three-core cables can be built up to pressures of 66,000 volts, the difficulty of handling them rapidly increases, and the tendency is to revert to three distinct single-core cables for such pressures. Such cables cannot economically be armored owing to the heavy iron losses, and there are also lead sheath circulating currents set up which add to the effective resistance of the conductor. Much research work has been carried out on the measurement of these losses, and it is now possible to predetermine them with reasonable accuracy in all practical cases. With unarmored cables the additional cooling effect obtained by separating the cores more than compensates for the extra heating caused by the sheath circulating currents.

No cables have yet been installed in Great Britain to operate at 132,000 volts, although they may be needed in certain sections of the proposed "grid" system now being prepared by the Central Electricity Board for the unification of English power supply. In this connection the recent 132,000-volt cable installations in America are being watched with considerable interest. In Chicago and New York the single-core cables for this pressure are formed, as is well-known, with a hollow conductor for oil circulation

which is connected at intervals along the line to oil reservoirs designed to take up the expansion and contraction of the compound. In New Jersey the cables installed are similar to the types used at 66,000 volts and have no special oil reservoirs. Possibly the structure found most suitable in the future will have no hollow conductor with reservoirs at long distances apart, but will utilize the full conductor section for copper, thus permitting the cable to run cooler, and will provide a continuous reservoir section outside the dielectric. Prolonged tests alone will indicate which method is best.

Statement of ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, of Wire & Wire Products published monthly at Washington, N. J., for April 1, 1928.

State of New York, County of New York, ss.: Before me, a Notary Public in and for the State and county aforesaid, personally appeared Sylvan Hoffman, who, having been duly sworn according to law, deposes and says that he is the publisher of the Wire & Wire Products and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Sylvan Hoffman, 114 E. 32nd Street, New York City; editor, William Gruen, 114 E. 32nd Street, New York City; business manager, Alan S. Cohen, 114 E. 32nd Street, New York City.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Hoffman Publications, Inc., 114 E. 32nd Street, New York City. Sylvan Hoffman, Alan S. Cohen, William Segal, all of 114 E. 32nd Street. New York City, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding one per cent of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

SYLVAN HOFFMAN.
(Signature of Publisher)

Sworn to and subscribed before me this 17th day of March, 1928.

(SEAL) GUSTAV COHEN,
Notary Public.

My commission expires March 30, 1928.

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ELMARID

The most improved metal composition die.

Manufactured in sizes ranging from .020" to .300"

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DIAMOND DIES

Highest Quality

Accurate Size Smooth Draw

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105-107 Fulton Street New York City

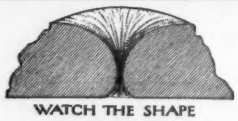
WIRE DRAWING DIAMOND DIES

Over 30 years experience in this line. The best equipped establishment in America with modern methods and machinery.

New way for re-inforcing the diamond.

(U. S. Patent 1,624,027. April 12, 1927.)
Tel. Webster 5105, Cable Address: Krauseco

F. KRAUSE & CO., Inc.
250-252-Ogden Ave.
JERSEY CITY, N. J.



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Wire Mill and Cold Rolling Equipment
10255 Harvard Ave.
CLEVELAND, OHIO

Domestic Exports of Iron and Steel Wire, Wire Rope and Nails, From the United States, By Countries

February, 1928

Countries	Plain iron or steel wire	Galvanized wire	Barbed wire	Wire rope	Insulated iron or steel wire and cable	Wire nails
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Belgium	1,776	.....	.....	.....	.....	.....
Denmark	1,052	.....	.....	.....	.....	.....
Finland	500	.....	.....	.....	.....	.....
France	.....	.....	.....	.....	44	.....
Italy	11,020	.....	.....	3,500	.....	.....
Norway	6,000	.....	.....	.....	.....	423
Poland & Danzig	.....	.....	.....	30,040	.....	.....
Rumania	.....	.....	.....	24,286	.....	.....
Soviet Russia in Europe	33,657	.....	.....	.....	.....	.....
Spain	1,365	.....	.....	.....	.....	.....
Sweden	200	.....	.....	.....	.....	.....
United Kingdom	112,985	44,206	.....	13,128	294	11,200
Canada	567,398	2,358,675	763,560	107,703	3,440	8,285
B. Honduras	.....	33	7,500	.....	.....	500
Costa Rica	3,102	7,585	50,000	4,394	.....	64,890
Gautemala	1,194	.....	31,670	279	385	9,640
Honduras	2,660	.....	87,000	1,378	.....	22,885
Nicaragua	1,335	.....	217,920	.....	.....	11,616
Panama	1,025	444	.....	63,301	28,491	12,225
Salvador	50	.....	34,170	.....	273	10,890
Mexico	112,649	71,206	1,349,323	103,029	6,648	42,339
Newfoundland & Labrador	1,700	.....	3,000	4,053	.....	13,275
Bermudas	55	221	.....	.....	.....	9,200
Barbados	.....	.....	.....	.....	700	.....
Jamaica	3,659	70	.....	.....	.....	2,109
Trinidad & Tobago	.....	3,378	.....	40,702	462	.....
Other B. W. Indies	500	.....	.....	6,795	2,610	2,700
Cuba	20,631	34,094	796,805	43,780	4,280	700,014
Dom. Rep.	200	2,630	50,300	617	.....	59,220
Netherland W. Indies	44	14,936	.....	.....	.....	1,000
Haiti, Rep. of	847	675	.....	.....	3,804	3,433
Virgin Is. of U. S.	.....	600	9,200	462	91	400
Argentina	577,573	1,932,067	3,686,570	37,781	.....	26,875
Bolivia	.....	.....	.....	47,052	.....	500
Brazil	146,343	1,339	1,085,838	43,645	3,710	.....
Germany	67,200	.....	.....	.....	.....	.....
Chile	17,299	62,345	9,716	118,314	.....	112,900
Colombia	5,396	64,030	654,240	37,774	.....	262,608
Ecuador	3,000	.....	4,000	.....	.....	4,524
B. Guiana	.....	.....	.....	75	.....	.....
Surinam	.....	.....	2,500	.....	.....	.....
Peru	5,297	1,562	85,111	48,853	.....	82,224
Uruguay	.....	45,080	.....	72	.....	.....
Venezuela	5,076	10,530	.....	6,341	136	200
Aden	.....	.....	.....	.....	9,475	.....
B. India	.....	.....	.....	18,559	.....	.....
B. Malaya	6,026	.....	45,331	.....	.....	200
Ceylon	.....	4,556	.....	.....	.....	.....
China	51,932	162,906	.....	40,108	4,183	63,700
Java & Madura	2,318	.....	224,824	84,853	.....	.....
Other Netherland E. Indies	.....	.....	30,424	144,207	534	3,727
Japan	157,694	42,208	.....	.....	.....	57,000
Philippine Is.	13,013	19,388	36,800	137,981	.....	711,170
Australia	9,375	77,973	2,224	18,816	2,256	215
B. Oceania	.....	.....	2,240	.....	.....	300
F. Oceania	.....	.....	600	.....	375	.....
N. Zealand	8,822	.....	.....	.....	40	180
Union of South Africa	2,660	272,400	414,870	3,586	.....	.....
Egypt	.....	.....	.....	920	.....	1,200
Other F. Africa	.....	.....	860	.....	.....	4,600
Liberia	.....	.....	.....	175	910	2,318,267
Total Quantity	**1,959,628**	**5,235,137**	**9,686,616**	**1,236,559**	**73,141**	**68,237**
Total Value	**109,510**	**132,042**	**271,214**	**170,034**	**13,692**	

Shipments from the United States to Non-Contiguous Territories.

Alaska	.....	.....	.....	.....	.....	66,266
Porto Rico	58,219	40,052	148,620	15,534	.....	175,815
Hawaii	55,494	22,766	21,192	77,050	15,091	64,139

Quarrying With Wire

(*Continued from page 165*)

One of the objections advanced against the use of the wire saw before actual trial was the high upward curve expected in the center of the cut. Continued experiments proved this a minor problem, cuts having been made 45 feet long, with a maximum upward curve of only two inches, by simply increasing the tension.

From careful checking up of tests under normal working conditions, the Bureau of Mines concludes that the wire saw

Domestic Exports of Iron and Steel Wire Manufactures, Horseshoe Nails and Horseshoes From the United States, By Countries

February, 1928

Countries	Woven wire fencing	Wire cloth & screening		Wire n. e. s. & manufactures of	Horseshoe nails	Horseshoes
	Pounds	Pounds	Dollars	Pounds	Pounds	Pounds
Guatemala	14,967	838	74	6,172	2,900	.....
Belgium	.....	.....	.....	439	5,445	.....
Denmark	206	98	60	1,506	.....	.....
France	.....	.....	.....	240	16,321	.....
Germany	.....	.....	.....	.....	52,736	.....
Italy	794	.....	.....	5,510	2,310	.....
Netherlands	.....	.....	.....	2,575	4,662	.....
Norway	9,000	.....	.....	3,508	.....	.....
Portugal	.....	.....	.....	45	.....	.....
Spain	.....	.....	.....	711	.....	.....
Sweden	.....	.....	.....	33	.....	.....
Switzerland	.....	.....	.....	4,594	660	.....
United King.	57,948	422	119	78,696	.....	.....
Canada	39,114	59,449	13,704	648,700	.....	1,062
B. Honduras	.....	52	10	270	2,800	.....
Nicaragua	519	.....	.....	237	.....	1,070
Panama	5,083	2,701	557	2,197	600	1,270
Salvador	2,170	.....	.....	1,469	100	.....
Mexico	235,074	46,046	5,596	121,804	11,279	4,917
Newfoundland & Labrador	2,000	2,681	429	1,917	1,875	.....
Bermudas	118	161	26	204	.....	1,691
Barbados	.....	175	31	.....	.....	.....
Jamaica	2,405	1,435	206	200	.....	.....
Trinidad & Tobago	2,870	1,068	128	164	.....	.....
Other B. W. Indies	1,807	3,068	308	1,002	.....	.....
Cuba	191,165	15,335	2,284	27,585	22,800	.....
Dom. Rep.	1,245	7,089	365	2,152	200	1,605
Haiti, Rep. of	116	205	41	230	.....	.....
Virgin, Is. of U. S.	.....	415	82	406	.....	300
Argentina	.....	.....	.....	8,587	2,788	8,700
Brazil	6,805	642	72	8,114	.....	.....
Brazil	6,085	642	72	8,114	.....	.....
Chile	9,440	1,990	672	14,572	18,847	400
Colombia	21,395	9,702	1,469	28,441	33,200	.....
Ecuador	.....	2,182	437	454	.....	.....
Paraguay	.....	.....	.....	14,767	.....	.....
Peru	.....	480	104	14,409	9,000	.....
Uruguay	.....	.....	.....	1,376	.....	.....
Venezuela	3,818	10,972	1,406	558	2,770	.....
B. India	5,680	3,407	947	.....	.....	100
B. Malaya	7,491	.....	.....	3,558	.....	.....
Honduras	1,858	6,254	716	739	200	.....
Ceylon	.....	.....	.....	286	.....	.....
China	475	8,097	1,639	170,559	2,730	.....
Java & Madura	32,189	24,931	1,965	.....	.....	.....
Hong Kong	.....	860	168	582	.....	.....
Iraq	480	.....	.....	6,670	.....	.....
Japan	25,356	5,335	1,263	134,504	48,500	.....
Kwantung	16,725	.....	.....	.....	.....	.....
Philppine Is.	184	11,809	1,924	23,238	.....	13,000
Australia	.....	11,237	1,803	90,899	.....	.....
B. Oceania	.....	45	15	.....	.....	.....
F. Oceania	600	40	26	210	.....	.....
N. Zealand	471	2,862	627	4,809	20,397	.....
Belgian Congo	.....	120	50	.....	.....	.....
Union of South Africa	1,886	7,906	2,825	1,056	.....	.....
Other B. S. Africa	.....	.....	.....	1,134	.....	.....
Egypt	.....	.....	.....	132	.....	.....
Other F. Africa	1,460	.....	.....	.....	.....	.....
Liberia	240	799	81	250	.....	.....
Mozambique	.....	.....	.....	898	.....	.....
Costa Rica	4,124	2,027	328	689	1,200	9,000
Neth. W. Ind.	2,100	364	78	148	.....	.....
Total Quantity	**709,378**	**254,311**	.....	**1,445,452**	**264,320**	**43,115**
Total Value	**42,575**	.....	**42,798**	**131,121**	**29,666**	**2,920**
Shipments from U. S. to						
Porto Rico	15,076	6,207	760	8,487	3,900	24,950
Hawaii	55,988	24,913	5,599	42,585	1,256	1,400

will cut from twice to four times as fast as a channeling machine at a correspondingly low cost and with no waste except the actual rock cut away. The wire saw lends itself readily to over-time work and the first cost is about one-fourth that of the equipment formerly used.

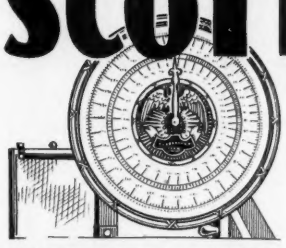
Now that wire saw quarrying has evidently been introduced into American quarries to stay, the use of sand screens will necessarily follow as auxiliary equipment. Sand free from loam and pebbles is desirable, and so far the most satisfactory results have been obtained with gray, fine white silica, and sea sand.

The Waterbury Wire Die Co.

Diamond and Chilled IRON DIES DIAMOND TOOLS

Waterbury, Conn.

SCOTT



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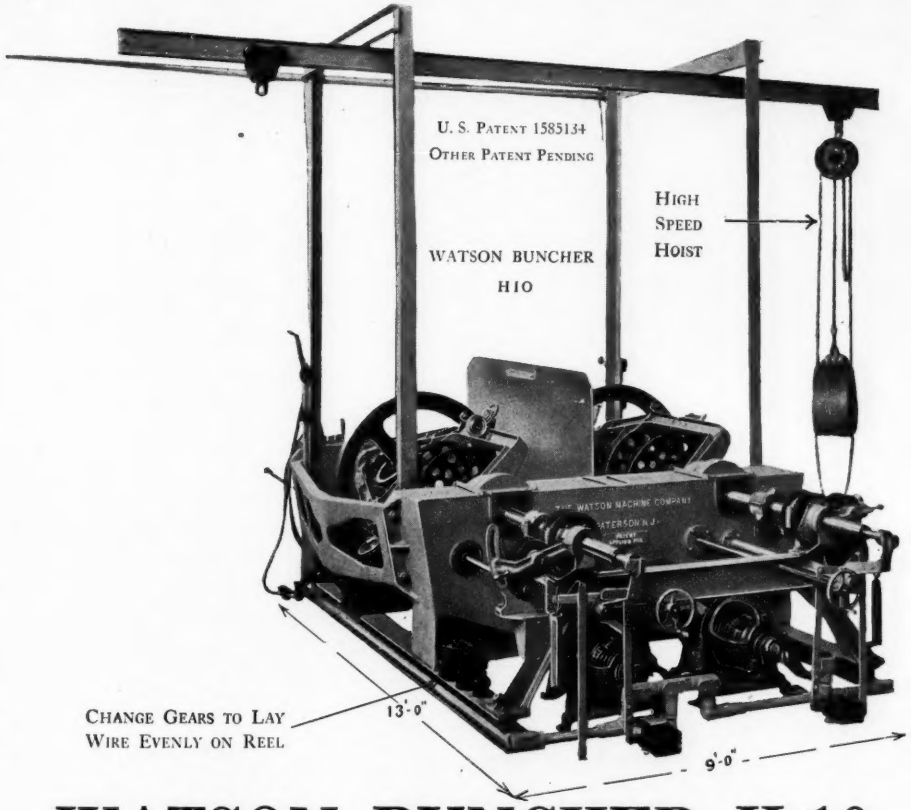

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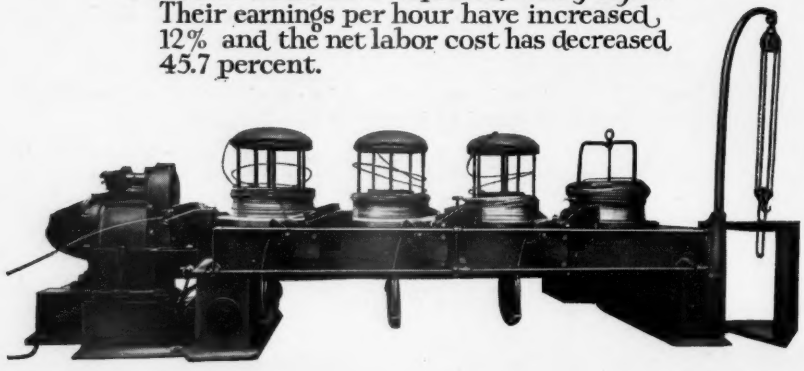

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